DOE/ID-11021
September 2003
Revision 1

Project No. 22801

U.S. Department of Energy
Idaho Operations Office

HWMA/RCRA Closure Plan for the TAN/TSF Intermediate-Level Radioactive Waste Management System

Phase I: Treatment Subsystem (TAN-616)

INEEL
Home of Science and Engineering Solutions
Idaho National Engineering and Environmental Laboratory

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ABSTRACT

The Test Area North/Technical Support Facility Intermediate-Level Radioactive Waste Treatment Subsystem, which includes the TAN-616 Liquid Waste Treatment Building, was an integral component of the Intermediate-Level Radioactive Waste Management System at Test Area North. This partial closure plan fulfills a milestone under Voluntary Consent Order Action Plan NEW-TAN-008 for closure of components addressed in this action plan that were determined to have managed hazardous waste. This plan is the first of three partial closure plans addressing Hazardous Waste Management Act/Resource Conservation and Recovery Act closure of the Intermediate-Level Radioactive Waste Management System, which is comprised of the feed subsystem (Collecting Tanks V-1, V-2, V-3, and Sump Tank V-9; addressed under the Federal Facility Agreement and Consent Order), the treatment subsystem (the TAN-616 facility and associated piping), and the holding tank subsystem (PM-2A tanks; addressed under the Federal Facility Agreement and Consent Order). The treatment subsystem, addressed in this plan, includes the TAN-607 decontamination room sump, Valve Pit #1 (TAN-1704), the TAN-615 east pit/sump, the TAN-616 head tank (V-5), the TAN-616 hold tank (15 gal), the TAN-616 pump room sump, the TAN-616 evaporator pit sump, TAN-616 evaporator pit lead shielding, and associated ancillary piping and equipment.

This closure plan specifies the role and boundaries of the Intermediate-Level Radioactive Waste Treatment Subsystem within the Intermediate-Level Radioactive Waste Management System. The current waste inventory and applicable hazardous waste numbers for the subsystem are provided. Finally, compliance with applicable tank system closure performance standards of Idaho Administrative Procedures Act 58.01.05.009 (40 Code of Federal Regulations 265.111 and 265.197) is included. This document also includes a description of activities required to complete closure and the criteria to which closure will be certified.

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FIGURES

TABLES

ACRONYMS

ANP	Aircraft Nuclear Propulsion
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
CSM	conceptual site model
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DQA	data quality assessment
EDF	Engineering Design File
EPA	U.S. Environmental Protection Agency
FFA/CO	Federal Facility Agreement and Consent Order
FR	Federal Register
FSP	Field Sampling Plan
HI	hazard index
HQ	hazard quotient
HWD	hazardous waste determination
HWMA	Hazardous Waste Management Act
HWN	hazardous waste number
IDAPA	Idaho Administrative Procedures Act
IDEQ	Idaho Department of Environmental Quality
IET	Initial Engine Test
ILRW	intermediate-level radioactive waste
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
IRIS	Integrated Risk Information System

LPT	Low-Power Test
NSIF	New Site Identification Form
PE	professional engineer
PPE	personal protective equipment
PRG	Preliminary Remediation Goal
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
SF	slope factor
STP	Shield Test Pool
TAN	Test Area North
TCE	trichloroethene
TSF	Technical Support Facility
UCL	upper confidence level
USC	United States Code
VCO	Voluntary Consent Order
VOE	verification of empty

HWMA/RCRA Closure Plan for the TAN/TSF Intermediate-Level Radioactive Waste Management System

Phase I: Treatment Subsystem (TAN-616)

1. INTRODUCTION

The Test Area North (TAN), located at the northern end of the Idaho National Engineering and Environmental Laboratory (INEEL), was constructed in the 1950s to support the Aircraft Nuclear Propulsion (ANP) Program. The radioactive wastewater generated during the ANP Program required treatment and storage. The Intermediate-Level Radioactive Waste (ILRW) Management System was constructed at the Technical Support Facility (TSF) to collect, store, and treat ILRW generated throughout the TAN facilities.

Portions of the ILRW Management System managed waste determined to be hazardous in accordance with the Hazardous Waste Management Act (HWMA) (State of Idaho 1983)/Resource Conservation and Recovery Act (RCRA) (42 United States Code [USC] 6901 et seq.). Therefore, these portions of the system will be closed in accordance with applicable closure standards under the Idaho Administrative Procedures Act (IDAPA), "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities" (IDAPA 58.01.05.009) (40 Code of Federal Regulations [CFR] Part 265, Subparts G and J).

The TAN/TSF ILRW Management System is composed of three subsystems: the ILRW Feed Subsystem (Tanks V-1, V-2, V-3, and V-9), the ILRW Treatment Subsystem (Liquid Waste Treatment Building [TAN-616]), and the ILRW Holding Tank Subsystem (PM-2A tanks). The ILRW Management System closure will be conducted as independent partial closures. Closure plans will be submitted and implemented independently until final facility closure is achieved. For purposes of this closure approach, the "facility" is comprised of the three subsystems, which currently represent the unclosed portions of the ILRW Management System. Each partial closure will constitute a closure phase with a total of three phases completing closure of the facility. The phases are as follows:

- Phase I: ILRW Treatment Subsystem (TAN-616)

- Phase II: ILRW Feed Subsystem (Tanks V-1, -2, -3, and -9)

- Phase III: ILRW Holding Tank Subsystem (PM-2A Tanks).

Final facility closure of the ILRW Management System will be completed upon the completion of all three partial closure phases. Closure certification will be provided for each partial closure phase of the project. The last partial closure certification for the ILRW Management System submitted to the Idaho Department of Environmental Quality (IDEQ) will incorporate, by reference, the preceding partial closure certifications to certify that the system has been closed.

This closure plan addressing the ILRW Treatment Subsystem, which is comprised of the TAN-616 building and associated ancillary equipment outside the building, has been written to fulfill a milestone of the Voluntary Consent Order (VCO) Action Plan NEW-TAN-008 (IDEQ 2000). The initial milestone submittal under VCO Action Plan NEW-TAN-008 was:

> *Complete a system identification for the portions of TAN-616 not managed under the [Federal Facility Agreement/Consent Order] and uniquely identify components addressed under this action plan.*

To adequately describe the TAN-616 system in accordance with the action plan requirements, the *Voluntary Consent Order NEW-TAN-008 System Identification* (INEEL 2001a) was prepared for submittal to the IDEQ. This system identification was approved by IDEQ on July 30, 2001 (IDEQ 2001).

Completion of hazardous waste determinations (HWDs) and/or verification of empty (VOE) determinations, as appropriate, for TAN-616 components is the second milestone submittal related to the tank system listed in this VCO action plan:

> *Complete a hazardous waste determination for the systems identified as* [TAN-616 systems, vessels, and ancillary equipment].

Four separate HWD/VOE Engineering Design Files (EDFs) were prepared to support characterization of the TAN-616 components:

- "VCO NEW-TAN-008 TAN-616 Liquid Waste Treatment Facility Characterization" (EDF-2793) – Approved by IDEQ on November 16, 2001 (Magleby 2001)
- "VCO NEW-TAN-008 TAN-616 Liquid Waste Treatment Facility Characterization – Interior Units" (EDF-2879) – Approved by IDEQ on May 29, 2002 (IDEQ 2002a)
- "VCO NEW-TAN-008 Characterization – TAN-615 Pits/Sumps" (EDF-2167) – Approved by IDEQ on June 27, 2002 (IDEQ 2002b)
- "VCO NEW-TAN-008 TAN-616 Liquid Waste Treatment Facility Characterization – Influent and Effluent Units and Associated Piping External to TAN-616" (EDF-2333) – Approved by IDEQ on December 23, 2002 (IDEQ 2002c).

These EDFs include a determination for each component identified in the NEW-TAN-008 System Identification (INEEL 2001a) as to whether that component managed hazardous waste. Process flow and plot plan schematics previously prepared for the system identification have been modified, updated, and revised to reflect the findings of the characterization process and are included in this closure plan. The original system identification schematics showed all components subject to characterization in red. The closure process flow schematic (Schematic P-CLOS-NEW-TAN-008-616A; Figure 1-1) and the closure plot plan (Schematic P-CLOS-NEW-TAN-008-616B; Figure 1-2) included in this closure plan show components in red that were determined to have managed hazardous waste and for which closure activities are required. Components shown in blue on these closure schematics were determined to be either nonhazardous (for waste management components) or empty (for process/product components) and no closure activities are required. Components shown in yellow/orange on the closure schematics will be evaluated as a follow-on VCO milestone (see Section 2.2.6). A summary of the conclusions of the aforementioned characterization EDFs is included in the following four paragraphs.

Characterization EDF-2793 was prepared to provide VOE documentation of the water tank (V-11; 98TAN00421). This process/product tank was used to store cooling water. The tank was visually verified as empty using common industrial practices as described in EDF-2793. No further closure activities were determined to be required for this tank and associated cooling water components; these components were moved to Appendix C of the VCO Action Plan – Covered Matters that are Closed upon approval of EDF-2793. The color of these components has been changed to green for equipment that does not require closure activities and has been removed per the findings of EDF-2793.

Characterization EDF-2879 was prepared to address equipment and components located within the TAN-616 building proper. The EDF addresses the head tank (V-5; 98TAN00427), the evaporator (V-7; 98TAN00429), the receiver (V-8; 98TAN00430), the hold tank (15 gal) (98TAN00417), the cyclone separator (V-6; 98TAN00428), and the condenser (E-1; 98TAN00420). In addition, ancillary components addressed include the piping ancillary to the caustic tank (V-4; Federal Facility Agreement and Consent Order [FFA/CO] Site TSF-19) inside of TAN-616, the evaporator pit sump (98TAN00419) and ancillary equipment, the pump room sump (98TAN00651) and ancillary equipment, line 104-A2-6", and lead sheet shielding on the evaporator pit floor. Several of these tanks, components, and associated ancillary piping were determined to have been emptied and closed using standard industrial practices before 1980; consequently, no further closure activities are required. The tanks and components addressed in EDF-2879 that were emptied prior to 1980 include the cyclone separator (V-6), evaporator (V-7), receiver (V-8), and condenser (E-1). This equipment was last used in 1972 and was verified as empty (inspection of interior or not designed to retain waste) as described in EDF-2879. No further closure activities were determined to be required for this equipment; it will be moved to Appendix C of the VCO Action Plan – Covered Matters that are Closed upon approval of this closure plan. The remainder of the equipment addressed in EDF-2879 was determined to have managed hazardous waste and requires activities under closure. The color of the cyclone separator (V-6), evaporator (V-7), receiver (V-8), condenser (E-1), and associated ancillary equipment was changed to blue for equipment not requiring closure activities per the findings of EDF-2879. The head tank, hold tank, pump room sump, evaporator pit sump, and associated ancillary equipment remained red, indicating that these components required activities under closure.

Characterization EDF-2167 was prepared to address the TAN-615 east pit/sump (98TAN00409) and west pit/sump (98TAN00320), and ancillary equipment. The west pit/sump was determined, based on process knowledge and analytical data, to have managed nonhazardous waste. The east pit/sump was determined to contain small quantities of residue that displayed a hazardous characteristic. Consequently, no further closure activities were determined to be required for the west pit/sump but are required for the east pit/sump. The west pit/sump was moved to Appendix C of the VCO Action Plan – Covered Matters that are Closed upon approval of EDF-2167. The east pit/sump required closure activities. As described later in this document, closure activities related to TAN-615 have been completed as interim actions under the NEW-TAN-008 Action Plan, and the color of the east pit/sump as well as the TAN-615 building on the process flow schematic (Schematic P-CLOS-NEW-TAN-008-616A; Figure 1-1) and the plot plan (Schematic P-CLOS-NEW-TAN-008-616B; Figure 1-2) have been changed to green for removed to reflect the findings of EDF-2167 and subsequent VCO interim actions and decontamination and decommissioning (D&D) efforts. All closure activities related to TAN-615 will be documented in the professional engineer's (PE's) certification for the closure of this tank system.

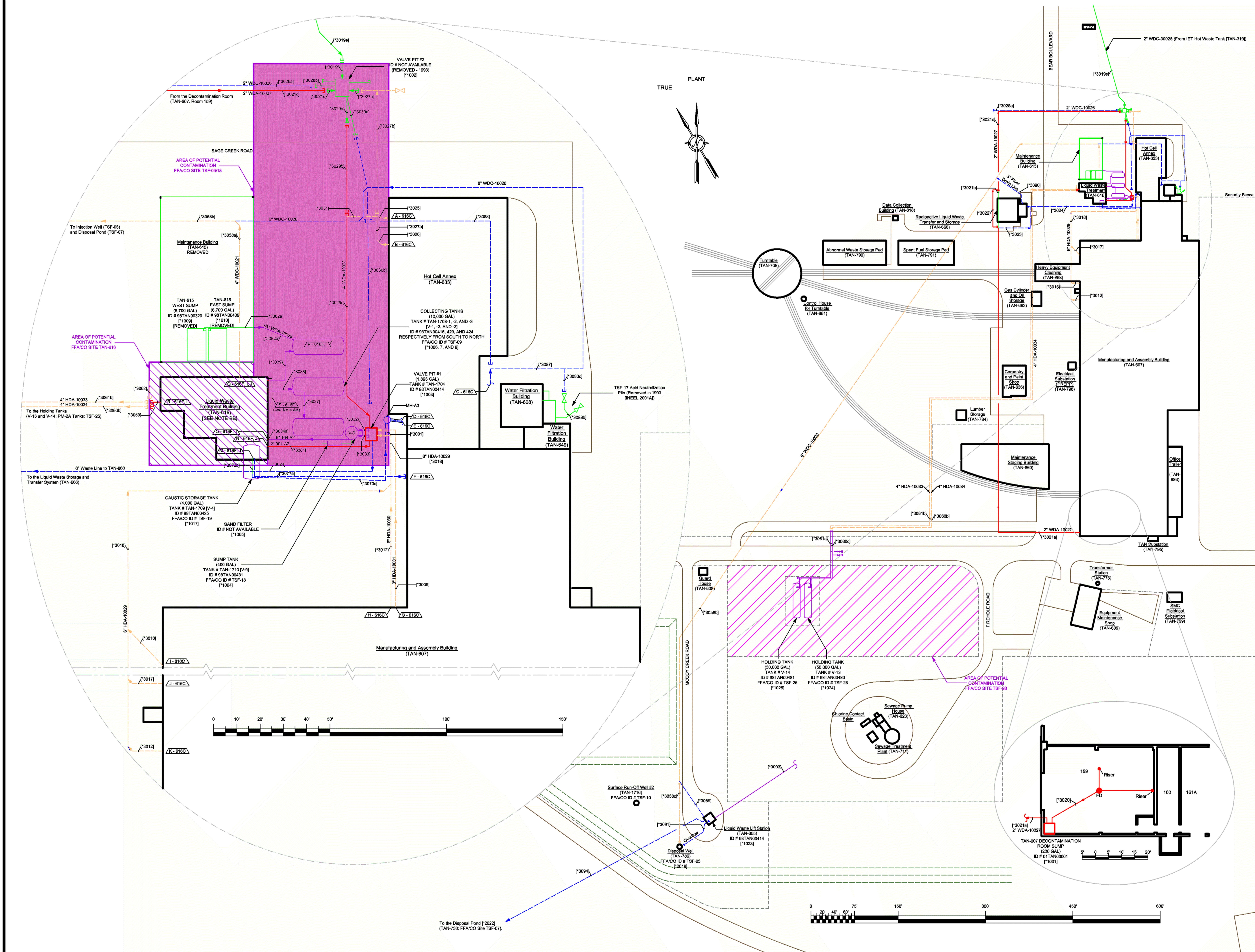
Characterization EDF-2333 was prepared to address the remainder of the components of the system that were not included in the three previous characterization EDFs. The remaining components consisted of a variety of lines external to the TAN-616 building. The lines were characterized as belonging to one of three categories: (1) piping that did not manage hazardous waste at any time and for which no further closure or VCO activities are required (changed to blue on the schematics), (2) piping outside building footprints that managed what would be considered to be hazardous waste prior to 1980 and that was emptied using common industrial practices prior to 1980 or only managed nonhazardous waste after 1980 (changed to yellow on the schematics), and (3) piping that managed hazardous waste after 1980 (left red on the schematics). Piping that never managed hazardous waste (changed to blue) was moved to Appendix C of the VCO Action Plan – Covered Matters that are Closed upon approval of EDF-2333. Piping that managed what would be considered hazardous waste but was emptied prior to 1980 (changed to yellow) is subject to follow-on VCO actions as specified in Section 2.2.6. Piping that managed hazardous waste after 1980 requires activities under closure and is described in detail in Section 2.2 of this closure plan.

This closure plan provides a general description of the ILRW Management System, as well as specific descriptions of the ILRW Treatment Subsystem components undergoing partial closure. The plan also includes the closure boundaries, a discussion of the current waste inventory, applicable U.S. Environmental Protection Agency (EPA) hazardous waste numbers (HWNs), and a detailed description of the activities that will be conducted to support closure certification. The HWMA/RCRA closure performance standard for tank systems (IDAPA 58.01.05.009 [40 CFR 265.111 and 265.197]) requires removal or decontamination of all waste residues, contaminated containment system components, contaminated soils, and structures and equipment contaminated with waste. The components listed in Section 2.2 of this plan will be closed by either removal or decontamination to the extent necessary to protect human health and the environment. Wherever practical, components and concrete structures will be removed and disposed of in accordance with applicable regulations. Certain components, including steel piping embedded in the structure of the Maintenance and Assembly Building (TAN-607), other sections of piping for which removal is not practical, and the decontamination room sump will be decontaminated in lieu of removal.

Soil sampling will be completed to assess if there has been a historical release of hazardous constituents to the environment from direct-buried (i.e., buried in direct contact with soil and not equipped with secondary containment) steel piping or concrete structures, if necessary, based on the results of integrity evaluation efforts. Analytical data collected under this closure for soils located within an established FFA/CO (DOE-ID 1991) site will be used to support remedial investigation and/or remedial actions under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC 9601 et seq.); no further activities with regard to these soils will be required under this HWMA/RCRA closure plan.

Upon completion of equipment removal or decontamination activities, if the results of soil sampling and associated risk assessment(s) indicate that soil contamination exists above risk-based criteria in an area not currently addressed in the FFA/CO, a New Site Identification Form (NSIF) under the FFA/CO will be completed. Contingent upon the approval of the NSIF by the Agencies, final remediation of the soil will be addressed through the CERCLA process (i.e., once the soil contamination area has been accepted into the FFA/CO for implementation of CERCLA remedial investigation, no further activities with regard to the soils will be required under HWMA/RCRA closure). Conversely, if soil sampling results indicate that soil contamination, if present, is below risk-based criteria, no further activities with regard to the soils will be required under HWMA/RCRA closure.

Figure 1-1. Schematic P-CLOS-NEW-TAN-008-616-A.



LEGEND

- BUILDINGS
- UNITS DETERMINED TO HAVE MANAGED HAZARDOUS WASTE
- LINES DETERMINED TO HAVE MANAGED HAZARDOUS WASTE
- UNITS DETERMINED TO BE EMPTY OR NONHAZARDOUS
- LINES DETERMINED TO BE EMPTY OR NONHAZARDOUS
- LINES SUBJECT TO EVALUATION FOR FURTHER HWMA/RCRA ACTIONS UNDER THE VCO
- REMOVED
- COMPONENTS REGULATED UNDER CERCLA
- ROADS
- SECURITY FENCE
- TOPOGRAPHICAL FEATURE
- RAILROAD

FFA/CO	FEDERAL FACILITY AGREEMENT AND CONSENT ORDER
IET	INITIAL ENGINE TEST
NaOH	SODIUM HYDROXIDE
PREPP	PROCESS EXPERIMENTAL PILOT PLANT
SMC	SPECIAL MANUFACTURING CAPABILITY
TSF	TECHNICAL SUPPORT FACILITY

A - 616C TIE POINTS TO THE FOLLOWING SYSTEM IDENTIFICATION SCHEMATICS (INEEL 2001A):
(EXAMPLE SHOWN: TIE POINT "A" ON SCHEMATIC P-VCO-NEW-TAN-008-616"C")
P-VCO-NEW-TAN-008-616C: TIE POINTS A TO L
P-VCO-NEW-TAN-008-616F: TIE POINTS M TO S
P-VCO-NEW-TAN-008-616I: TIE POINTS Q, P, R
P-VCO-NEW-TAN-008-616J: TIE POINTS M, N, O, Q

*: EQUIPMENT DESIGNATION NUMBERS BEGINNING WITH AN ASTERISK WERE ASSIGNED BY THE SYSTEM IDENTIFICATION TEAM. FOR MORE INFORMATION, PLEASE SEE THE CORRESPONDING ENTRY IN TABLE NEW-TAN-008-A IN THE SYSTEM IDENTIFICATION DOCUMENT (INEEL 2001A).

- FFA/CO SITE TAN-616 AREA OF POTENTIAL CONTAMINATION
- FFA/CO SITE TSF-09/18 AREA OF POTENTIAL CONTAMINATION
- FFA/CO SITE TSF-26 AREA OF POTENTIAL CONTAMINATION

HAZARDOUS UNITS SHOWN ON THIS PLOT

98TAN00409
98TAN00414
00TAN00001

REFERENCE DOCUMENTS

EDF-2167
EDF-2333
EDF-2793
EDF-2879
INEEL 2001A

HAZARDOUS WASTE DETERMINATION SCOPE

THE REFERENCE LIST ABOVE INCLUDES FOUR HAZARDOUS WASTE DETERMINATION ENGINEERING DESIGN FILES THAT COMPRISE THE HAZARDOUS WASTE DETERMINATION FOR THE ILRW TREATMENT SYSTEM (TAN-616) REQUIRED UNDER VCO ACTION PLAN NEW-TAN-008. THE SCOPE OF THE HAZARDOUS WASTE DETERMINATIONS IS AS FOLLOWS:

EDF-2167, "VCO NEW-TAN-008 TAN-616 LIQUID WASTE TREATMENT FACILITY CHARACTERIZATION - TAN-615 PITS/SUMPS." THIS DOCUMENT (APPROVED BY IDEQ) ADDRESSES EQUIPMENT LOCATED INSIDE TAN-615.

EDF-2333, "VCO NEW-TAN-008 TAN-616 LIQUID WASTE TREATMENT FACILITY CHARACTERIZATION - INFLUENT AND EFFLUENT UNITS AND ASSOCIATED PIPING EXTERNAL TO TAN-616." THIS DOCUMENT (APPROVED BY IDEQ) ADDRESSES EQUIPMENT LOCATED OUTSIDE OF TAN-615 AND -616.

EDF-2793, "VCO NEW-TAN-008 TAN-616 LIQUID WASTE TREATMENT FACILITY CHARACTERIZATION - VERIFICATION OF EMPTY FOR V-11." THIS DOCUMENT (APPROVED BY IDEQ) ADDRESSES PROCESS/PRODUCT COOLING WATER EQUIPMENT INSIDE TAN-616.

EDF-2879, "VCO NEW-TAN-008 TAN-616 LIQUID WASTE TREATMENT FACILITY CHARACTERIZATION - INTERIOR UNITS." THIS DOCUMENT (APPROVED BY IDEQ) ADDRESSES EQUIPMENT LOCATED INSIDE TAN-616.

NOTES

FOR BOUNDARY DISCUSSIONS, REFER TO SCHEMATIC P-CLOS-NEW-TAN-008-616A.

AA. ONLY THE WASTE INLET LINES TO V-1, V-2, AND V-3 ARE SHOWN. FOR COMPLETE PIPING PLAN OF ALL LINES CONNECTING V-1, V-2, AND V-3 TO TAN-616, SEE SCHEMATIC P-VCO-NEW-TAN-008-616F, WHICH IS INCLUDED IN THE VCO ACTION PLAN NEW-TAN-008 SYSTEM IDENTIFICATION (INEEL 2001A).

BB. FOR DETAILS CONCERNING PIPING INSIDE TAN-616, SEE SCHEMATIC P-CLOS-NEW-TAN-008-616A.

REVISIONS

1	UPDATED SYSTEM BOUNDARIES AND CORRECTED DECONTAMINATION SHOP DRAIN NETWORK	09/24/03	BDW

VOLUNTARY CONSENT ORDER PROGRAM

THIS SCHEMATIC IS PROVIDED AS A SUPPLEMENT TO THE VOLUNTARY CONSENT ORDER PROGRAM'S HWMA/RCRA CLOSURE EFFORT. THIS SCHEMATIC IS NOT INTENDED TO BE USED AS A PIPING AND INSTRUMENTATION DIAGRAM NOR IS IT MANAGED BY INEEL CONFIGURATION CONTROL. THIS SCHEMATIC IS FOR VCO PROGRAM USE ONLY.

IDAHO NATIONAL ENGINEERING AND ENVIRONMENTAL LABORATORY
TEST AREA NORTH/TECHNICAL SUPPORT FACILITY
ILRW TREATMENT SUBSYSTEM
PIPING PLAN AND DETAILS

SCHEMATIC NUMBER: P-CLOS-NEW-TAN-008-616B
REVISION: 1
SCALE: SHOWN
DATE: 07/17/02
RESEARCH: PORTAGE, INC.
DRAWING: PORTAGE, INC.

Figure 1-2. Schematic P-CLOS-NEW-TAN-008-616-B.

2. FACILITY DESCRIPTION

Test Area North was established in the 1950s by the United States Air Force and Atomic Energy Commission ANP Program to support nuclear-powered aircraft research. As a nuclear research facility, radioactive wastewater was generated at several of the TAN facilities. Originally, TAN, which is located at the north end of the INEEL (see Figure 2-1), included the TSF, the Initial Engine Test (IET) Facility, the Flight Engine Test Facility, the Shield Test Pool (STP) Facility, and the Low-Power Test (LPT) Facility. The STP facility was later converted to the Experimental Beryllium Oxide Reactor, which was never used.

The TSF was designed to provide centralized management and services for the ANP Program. The service functions included equipment fabrication and assembly, fuel fabrication and inspection, post-irradiation fuel examination, disassembly and examination of equipment exposed to high-level radiation fields, equipment decontamination and repair, and low-level liquid waste concentration and storage in the ILRW Management System. The consolidation of these service functions at TSF eliminated much duplication at the various test facilities and largely limited the work at these locations to the installation and removal of prefabricated units and decontamination of permanently installed equipment (Kerr 1971).

2.1 ILRW Management System Description

The ILRW Management System was constructed in 1955 and began operation in 1958 (Evans and Perry 1993). It was designed to collect, store, and concentrate radionuclide-contaminated liquid waste from TAN facilities. Radioactive liquid waste generated throughout the TAN facilities was piped or trucked to the ILRW Management System from the IET facility and the LPT facility (Hogg et al. 1971; Kerr 1971). However, the majority of radioactive liquid waste generated at TAN was from the decontamination of both equipment and facilities at TSF (Kerr 1971).

The TAN/TSF ILRW Management System is composed of three subsystems: the ILRW Feed Subsystem (Tanks V-1, V-2, V-3, and V-9), the ILRW Treatment Subsystem (TAN-616), and the ILRW Holding Tank Subsystem (PM-2A tanks). Beginning in 1958, these three subsystems were used to collect and treat radioactive wastewater at TAN as follows:

- The feed subsystem was used to collect and store waste prior to treatment
- The treatment subsystem was used to concentrate the waste using evaporation, resulting in a waste concentrate stream
- The holding tank subsystem was used to collect and store the waste concentrate.

In 1971, a temporary aboveground evaporator (PM-2A) was installed to empty the holding tank subsystem. The PM-2A evaporator was used to empty the holding tanks (V-13 and V-14) and potentially for additional transfers of waste from the collecting tanks via the TAN-616 facility. The PM-2A evaporator was taken out of service in 1975 and all aboveground structures and equipment associated with this evaporator were subsequently removed.

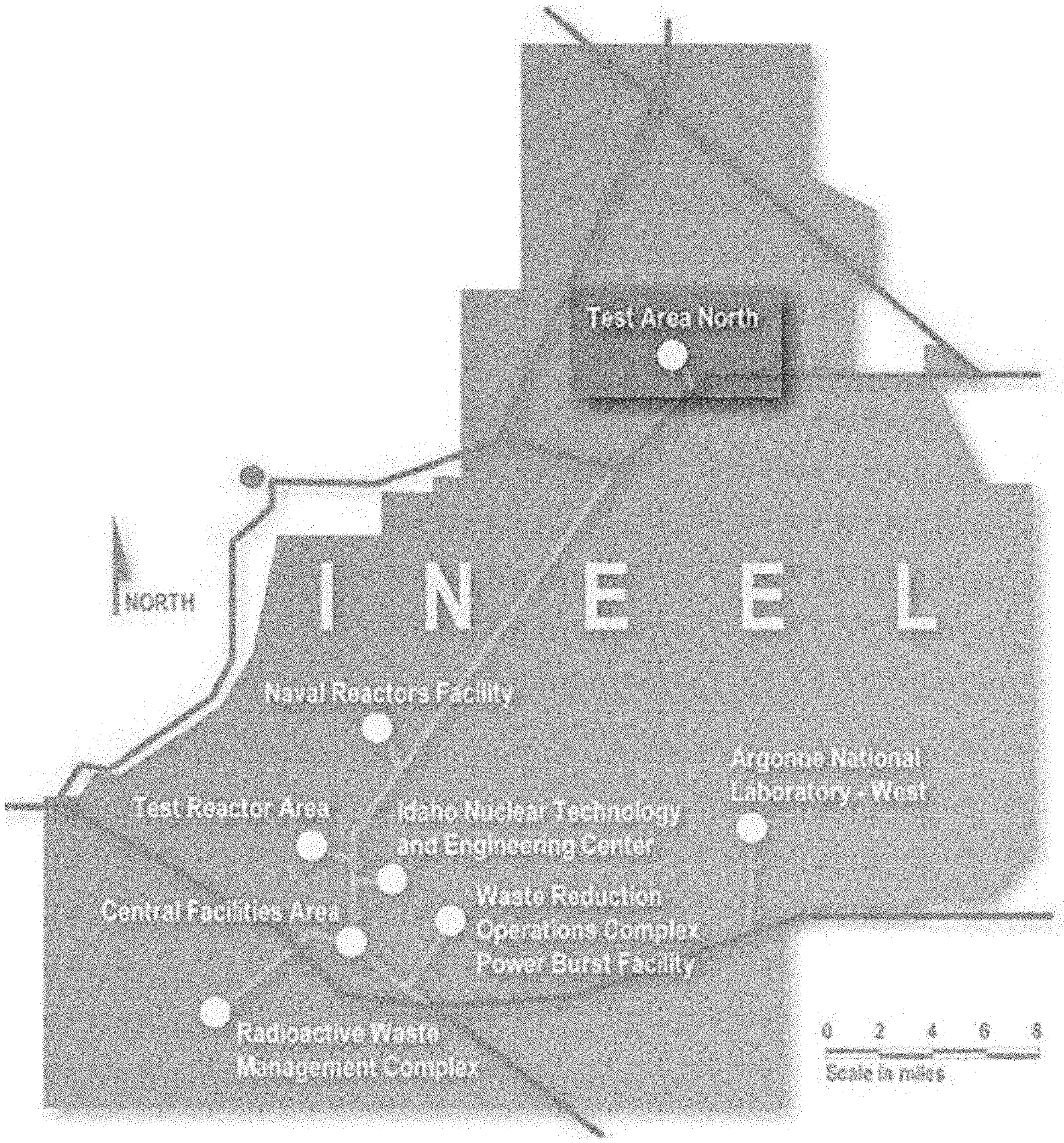


Figure 2-1. Map of the INEEL showing the location of TAN.

In 1972, the TAN-616 evaporator system was removed from service. Subsequent to this date, the TAN-616 facility was used only as a waste transfer building. Between 1972 and 1974, waste collected in the feed subsystem may have been transferred directly to the holding tank subsystem for processing in the PM-2A evaporator. The TAN-616 facility was modified in 1974 to allow transfer of waste from the collecting tanks to a tank truck using equipment and piping inside the TAN-616 building. A vacuum pump and hold tank (15 gal) were added to the operating pump room and a small blue centrifugal waste transfer pump was added to the pump room. The vacuum pump and hold tank (15 gal) were used to prime the blue transfer pump. New piping was added to the pump room, operating pump room, caustic pump room, and building exterior; some existing piping was used to complete flow paths from the collecting tanks to the truck loading discharge. Waste from the collecting tanks was transferred to tank trucks using this apparatus until sometime prior to 1981. Between 1981 and 1985, the collecting tanks were subsequently used for collection and storage. By 1981, transfer of waste from the collecting tanks was performed using an in-tank submersible pump and pumping directly to tank trucks.

The three subsystems are addressed under different regulatory frameworks. The feed subsystem (Tanks V-1, -2, -3, and -9) and holding tank subsystem (PM-2A tanks) are addressed under FFA/CO (DOE-ID 1991) Sites TSF-09/18 and TSF-26, respectively. The treatment subsystem (the subject of this partial closure plan) is addressed under the VCO. A more detailed description of the treatment subsystem components addressed in this partial closure plan is provided in Section 2.2; the HWNs applicable to the waste managed in these components are provided in Section 3.2.

The lists of subsystem-specific components for Phase II, which includes the collecting tanks (V-tanks [TSF-09/18]) and Phase III, which includes the holding tanks (PM-2A tanks [TSF-26]), will be provided in the corresponding partial closure plans. Operational descriptions of the ILRW Feed and Holding Tank Subsystems are included in the subsequent sections of this closure plan for information only.

2.1.1 ILRW Feed SubSystem

The ILRW Feed Subsystem was used to collect, clarify, store, and transfer radioactive wastes to the ILRW Treatment Subsystem. The ILRW Feed Subsystem consisted of five components: a sump tank (V-9) [*1004[a]]; three collecting tanks (V-1, -2, and -3) [*1006, *1007, and *1008]; a sand filter [*1005]; as well as associated ancillary piping.

The ILRW Feed Subsystem collected radioactive wastes from various sources throughout TAN. A piping network[b] collected liquid waste from floor drains, sinks, sumps, tanks, and hoods in TAN-607, the Water Filtration Building (TAN-649), the Hot Cell Annex (TAN-633), the Maintenance Building (TAN-615), and the IET Control and Equipment Building (TAN-620). The wastes drained through this pipe system to either Valve Pit #2 [*1002] or Valve Pit #1 (TAN-1704) [*1003]. Valve Pit #2 drained to Valve Pit #1. From Valve Pit #1, the waste drained to the sump tank (V-9) [*1004], which was designed

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a. Four-digit equipment numbers preceded by an asterisk were assigned to all tanks and components associated with the TAN-616 Liquid Waste Treatment System as part of the system identification for VCO Action Plan NEW-TAN-008 (INEEL 2001a). These numbers were assigned to ensure consistency throughout compliance activities related to the ILRW Management System. These equipment numbers are not related to INEEL facility equipment numbers or to INEEL Tank Inventory Database identification numbers.

b. Although the inlet piping and Valve Pit #1 are operationally associated with the ILRW Feed System, this structure and piping were outside the established boundaries of the FFA/CO sites associated with the feed subsystem (FFA/CO sites TSF-09/18); consequently, this structure and piping were identified as part of the TAN-616 system in the system identification (INEEL 2001a).

to clarify the liquid prior to introduction of the liquid into the collecting tanks. Liquid waste flowed through the sump tank (V-9) and into the collecting tanks (V-1, -2, and -3) [*1006, *1007, and *1008] where it was stored prior to concentration by evaporation. A caustic supply tank (V-4) supplied 50% sodium hydroxide solution to the collecting tanks for pH adjustment. The collecting tanks could also receive wastes directly from the TAN-615 sumps (connected directly to Collecting Tank V-3) or from the LPT facility via a transfer truck through a standpipe extending to the ground surface from each of the collecting tanks (Hogg et al. 1971; Kerr 1971). The collecting tanks, sump tank, sand filter, and associated piping comprise the ILRW Feed Subsystem (Phase II).

2.1.2 ILRW Holding Tank Subsystem

Waste collected in the ILRW Feed Subsystem was concentrated by evaporation in TAN-616. Concentrated radioactive waste from the ILRW Treatment Subsystem evaporator was jetted to the two 50,000-gal underground holding tanks (PM-2A tanks, V-13 and V-14 [*1024 and *1025]) via two buried waste lines. The holding tanks are located approximately 750 ft south and 400 ft east of TAN-616. These tanks were used to receive and store waste concentrate from the TAN-616 evaporator until 1972 when the TAN-616 evaporator was removed from service. These tanks were designed to provide indefinite storage, as there is no permanent means to empty the tanks. From 1971 to 1975, these tanks were emptied using temporary piping connected to the PM-2A evaporator system. The PM-2A evaporator system was removed as a D&D activity in 1981 and 1982, at which time the tanks were emptied to their respective heels and the heels solidified with diatomaceous earth (Smith 1983). The holding tanks and associated piping comprise the ILRW Holding Tank Subsystem (Phase III).

2.2 ILRW Treatment Subsystem Description and Boundaries

A description of equipment identified in the VCO Action Plan NEW-TAN-008 System Identification (INEEL 2001a) and subsequently characterized as hazardous waste management equipment requiring closure activities in the EDFs (EDF-2167; EDF-2333; EDF-2879) is provided below. The ILRW Treatment Subsystem includes the TAN-607 decontamination room sump [*1001], Valve Pit #1 (TAN-1704 [*1003]), TAN-615 east pit/sump [*1010], head tank (V-5 [*1011]), hold tank (15 gal) [*1016], pump room sump [*1020], evaporator pit sump [*1021], and associated ancillary piping and equipment. A list of the ILRW Treatment Subsystem components that were determined to have managed hazardous waste is included in Table 2-1.

2.2.1 Tanks

The tanks included in the ILRW Treatment Subsystem are the head tank [*1011] and the hold tank (15 gal) [*1016]. Both units are shown on Schematic P-CLOS-NEW-TAN-008-616A (see Figure 1-1).

2.2.1.1 Head Tank. The head tank (V-5; 98TAN00427) is a 1,000-gal elliptical bottom, flat top, vertical, stainless steel tank, located in the TAN-616 evaporator pit. It has an outside diameter of 1.8 m (6 ft) and a height of 2.1 m (7 ft). The head tank received process waste from the collecting tanks (V-1, V-2, and V-3) via Pumps P-1 and P-1A. The head tank gravity-fed the evaporator (V-7). The head tank was operational from 1958 until approximately 1972 as a feed unit to the evaporator. The manway at the top of the head tank was open and solids were present in the tank bottom when sampled in 1993/1994 (Olaveson et al. 1994) and January 2001. Based on information from measurements during a May 2001 entry, it is estimated that approximately 0.5 in. to 4.5 in. (~2 ft^3) of sediment remains in the bottom of the head tank.

2.2.1.2 Hold Tank (15 gal). The hold tank (15 gal) (98TAN00417) is located in the operating pump room. The hold tank (15 gal) is a vertical cylinder that is 0.3 m (1 ft) in diameter and 0.6 m (1.8 ft) in height and has elliptical heads. It was installed in 1974 as part of a vacuum system that was used to prime the new blue transfer pump, which allowed transfer of waste from the collecting tanks (V-1, -2, and -3) to the swing-arm loading pipe mounted on the side of the building. The vacuum pump and hold tank (15 gal) were used to temporarily apply negative gauge pressure to the blue pump discharge line, thereby flooding the pump and the suction lines from the collection tanks. The hold tank (15 gal) was most likely used from its installation in 1974 until sometime prior to 1981. Installation of the transfer piping and a vacuum pump were performed at the same time as the installation of this tank.

Table 2-1. ILRW Treatment Subsystem components that were determined to have managed hazardous waste.

Reference Number	Description	INEEL Unit Number
Tanks		
*1011	Head Tank	V-5; 98TAN00427
*1016	Hold Tank (15 gal)	98TAN00417
Piping		
*3020	TAN-607 Decontamination Room Drainlines	N/A
*3021a	TAN-607 Decontamination Room Sump (01TAN00001) Discharge Line	2" WDA-10027
*3021c	TAN-607 Decontamination Room Sump (01TAN00001) Discharge Line	2" WDA-10027
*3022	TAN-607 Decontamination Room Sump (01TAN00001) Discharge Line (TAN-666 Construction Cross-Tie)	N/A
*3029b	Replacement Valve Pit #2 (TSF-21) – Valve Pit #1 (TAN-1704; 98TAN00414) Drainline	4" WDA-10023
*3029c	Replacement Valve Pit #2 (TSF-21) – Valve Pit #1 (TAN-1704; 98TAN00414) Drainline	4" WDA-10023
*3032a	Valve Pit #1 (TAN-1704; 98TAN00414) – Sump Tank (V-9; 98TAN00431) Drainline	3" A2-101
*3033a	Valve Pit #1 (TAN-1704; 98TAN00414) – Sump Tank (V-9; 98TAN00431) Drainline	6" A2-102
*3034b	Sump Tank (V-9; 98TAN00431) – TAN-616 Drainline[a]	6" A2-104
*3037a	Collecting Tank (V-1; 98TAN00416) Feed Line[a]	6" A2-104
*3038a	Collecting Tank (V-2; 98TAN00423) Feed Line[a]	6" A2-104
*3039a	Collecting Tank (V-3; 98TAN00424) Feed Line[a]	6" A2-104
*3040b	Collecting Tank (V-1; 98TAN00416) Suction Line[a]	4" A2-105
*3041b	Collecting Tank (V-2; 98TAN00423) Suction Line[a]	4" A2-105
*3042b	Collecting Tank (V-3; 98TAN00424) Suction Line[a]	4" A2-105
*3043	Process Pump Inlet Header	4" A2-105
*3044	Process Pump Discharge Line/Collecting Tank Return Line	4" A2-106
*3045a	Collecting Tank (V-1; 98TAN00416) Return Line[a]	4" A2-106
*3046a	Collecting Tank (V-2; 98TAN00423) Return Line[a]	4" A2-106
*3047a	Collecting Tank (V-3; 98TAN00424) Return Line[a]	4" A2-106
*3048	Head Tank (V-5; 98TAN00427) Charge Line	3" A2-107
*3049	Head Tank (V-5; 98TAN00427) Overflow Line	4" A2-118/4" A2-117/4" A2-119

Table 2-1. (continued).

Reference Number	Description	INEEL Unit Number
*3050	Head Tank (V-5; 98TAN00427) Discharge Line	2" A2-108
*3059	TAN-616 Evaporator (V-7; 98TAN00429) Bottoms Discharge Header	4" A2-123
*3060a	TAN-616 Evaporator (V-7; 98TAN00429) Bottoms Discharge Line	4" HDA-10034
*3061a	TAN-616 Evaporator (V-7; 98TAN00429) Bottoms Discharge Line	4" HDA-10033
*3070a	Blue Pump Prime Line	N/A
*3070b	Vacuum Pump Inlet Line	N/A
*3070c	Vacuum Pump Drainline	N/A
*3071	Floor Sink Drainline	N/A
*3079	Pump Room Sump (98TAN00651) Discharge Line	1" A2-901
*3080	Evaporator Pit Sump (98TAN00419) Discharge Line	1" A2-901
*3081	TAN-616 Sump Discharge Header	2" A2-901
*3098	Evaporator Header Return Line	2" A2-120
*3099	Evaporator Bypass Line	4" A2-122
N/A	New 2-in. Piping	N/A
Pumps/Jets		
*2001	TAN-607 Decontamination Room Sump Pump	SP-201B
*2004	Process Pump	P-1
*2005	Process Pump	P-1A
*2011	Concentrate Transfer Jet	J-6
*2015	Vacuum Pump	N/A
*2017	TAN-616 Pump Room Sump Jet	J-5
*2018	TAN-616 Evaporator Pit Sump Jet	J-4
N/A	New Transfer Pumps	N/A
Sumps/Structural Components		
*1001	TAN-607 Decontamination Room Sump	01TAN00001
*1003	Valve Pit #1	TAN-1704; 98TAN00414
*1010	TAN-615 East Pit/Sump	98TAN00409
*1020	TAN-616 Pump Room Sump and Floor	98TAN00651
*1021	TAN-616 Evaporator Pit Sump, Floor, and Walls	98TAN00419
Miscellaneous		
*2014	Floor Sink	N/A
N/A	Lead Sheeting	N/A

a. Any contents within the lines between the TAN-616 building and Tanks V-1, V-2, and V-3 will be removed as part of the TSF-09 remedial action and managed under CERCLA with the contents of these tanks. Any contents within line 104-A2-6", located inside TAN-616, will be removed and managed under CERCLA as part of the contents removal for V-1, V-2, V-3, and V-9 (FFA/CO Sites TSF-09 and TSF-18).

2.2.2 Piping and Ancillary Equipment

2.2.2.1 Description. The TAN/TSF ILRW Treatment Subsystem includes waste transfer piping as shown on Schematics P-CLOS-NEW-TAN-008-616A and -616B (see Figures 1-1 and 1-2). The piping included in the ILRW Treatment Subsystem that requires HWMA/RCRA closure activities is shown in red on the schematic. The necessity of closure activities was determined based upon characterization results, which are included in the characterization EDFs (EDF-2167; EDF-2333; EDF-2879). A list of piping and ancillary equipment requiring closure activities is provided in Table 2-1.

2.2.2.2 Piping Boundaries. Inlet and outlet boundaries have been established to define breakpoints for piping requiring closure activities between the ILRW Treatment Subsystem and the ILRW Feed and Holding Tank Subsystems. The boundaries for the ILRW Treatment Subsystem are listed below and shown on Schematic P-CLOS-NEW-TAN-008-616A (Figure 1-1):

1. Inlet and outlet lines, 2" WDA-10027 [*3021c] and 4" WDA-10023 [*3029b], that were formerly connected to Valve Pit #2 were cut and capped near the valve pit in 1993 (see Schematic P-CLOS-NEW-TAN-008-616B [Figure 1-2]). These lines were determined to have managed hazardous waste and will be addressed under this closure plan to the point at which they were cut and capped in 1993. Valve Pit #2 and the associated pipe stubs will be addressed as part of the feed subsystem closure (Phase II).

2. The discharge lines from Valve Pit #1 to the sump tank (V-9) have been cut and capped inside the valve pit (INEEL 2001a). These lines (101-A2-3" and 102-A2-6") were determined to have managed hazardous waste and will be addressed under this closure plan to the existing caps inside the valve pit. The portions of these lines from the existing caps inside the valve pit to the sump tank (V-9) will be addressed as part of the feed subsystem closure (Phase II).

3. Lines located inside TAN-616 that connect the TAN-616 building to the collecting tanks (V-1, -2, and -3) and the sump tank (V-9) were determined to have managed hazardous waste and will be addressed under this closure plan to 6 in. outside the TAN-616 building wall. The remainder of these lines will be included as part of the feed subsystem closure (Phase II) (see the NEW-TAN-008 System Identification [INEEL 2001a] Schematics P-VCO-NEW-TAN-008-616E through -616K for detailed piping plans and sections for piping inside and east of TAN-616). The contents of the lines between the TAN-616 building and Tanks V-1, V-2, and V-3 will be removed as part of the TSF-09 remedial action and managed under CERCLA with the contents of these tanks. The contents of line 104-A2-6", located inside TAN-616, will also be removed and managed under CERCLA as part of the contents removal for V-1, V-2, V-3, and V-9 (FFA/CO Sites TSF-09 and TSF-18).

2.2.3 Pumps and Jets

The following pumps and jets, shown on Schematic P-CLOS-NEW-TAN-008-616A (see Figure 1-1) and listed in Table 2-1, were determined to have managed hazardous waste and are included as part of the HWMA/RCRA closure of the ILRW Treatment Subsystem:

- TAN-607 Decontamination Room Sump Pump—This pump was used to transfer liquids that have subsequently been characterized as hazardous waste (see Section 3) from the decontamination room sump to Valve Pit #2. This pump was actively used from 1975 until the mid-1980s, and was not used thereafter.

- Process Pumps (P-1 and P-1A)—These pumps, located in the TAN-616 pump room, were used from 1958 to 1975 to transfer waste from the collecting tanks to the head tank (V-5) or the holding tanks (PM-2A tanks, V-13 and V-14). The piping connected to these pumps was part of the 1974 upgrade waste transfer flow path, which has been determined to have managed hazardous waste, that was used until sometime prior to 1981. As a result, hazardous waste may have flowed into or through the pumps until sometime prior to 1981.

- Concentrate Transfer Jet (J-6)—This jet, located in the TAN-616 evaporator pit, was used from 1958 to 1972 to transfer waste concentrate from the evaporator (V-7) to the holding tanks (PM-2A tanks, V-13 and V-14). The jet may have been used until 1975 to transfer waste directly from the collecting tanks (V-1, -2, and -3) to the holding tanks. This component will be closed as equipment ancillary to the head tank (V-5; 98TAN00427).

- Vacuum Pump—This pump is located in the operating pump room. It was installed in 1974 as part of a vacuum system that was used to prime the new blue transfer pump, which allowed transfer of waste from the collecting tanks (V-1, -2, and -3) to the swing-arm loading pipe. The vacuum pump and hold tank (15 gal) were used to temporarily apply negative gauge pressure to the blue pump discharge line, thereby flooding the pump and the suction lines from the collection tanks. The hold tank (15 gal) was most likely used from its installation in 1974 until sometime prior to 1981. This pump may have managed hazardous waste from the collecting tanks during the pump priming operation.

- TAN-616 Pump Room Sump Jet (J-5) and Evaporator Pit Sump Jet (J-4)—These jets were used to transfer waste from the sumps to the collecting tanks (V-1, -2, and -3) via Valve Pit #1 and the sump tank (V-9). These jets are ancillary to the respective sumps.

- New Transfer Pumps—These pumps were installed in 1974 and were used to transfer waste from the collecting tanks (V-1, -2, and -3) to the swing-arm loading pipe attached to the building. The pump and swing arm may have been used from their installation in 1974 until sometime prior to 1981. These pumps were used to transfer hazardous waste from the collecting tanks until sometime prior to 1981.

2.2.4 Sumps and Structural Components

A discussion of the physical configuration of the valve pit and the sumps included in the ILRW Treatment Subsystem is included below. The sumps and structural components included in the ILRW Treatment Subsystem are the TAN-607 decontamination room sump [*1001], Valve Pit #1 [*1003], the TAN-615 east pit/sump [*1010], the TAN-616 pump room sump [*1020], and the TAN-616 evaporator pit sump [*1021]. Schematics P-CLOS NEW-TAN-008-616A (Figure 1-1) and P-CLOS NEW-TAN-008-616B (Figure 1-2) show the process flow schematic and system plot plan showing each of these units.

2.2.4.1 TAN-607 Decontamination Room Sump. The TAN-607 decontamination room sump (01TAN00001) is a 600-gal sump that received low-level radioactive waste discharges from the decontamination room. The sump measures 1.2 m (4 ft) by 1.2 m (4 ft) by 1.6 m (5.0 ft) in depth. The sump is lined with stainless steel that has been coated with an epoxy paint. The decontamination room was active from 1957 to approximately 1975 (INEEL 2001a). From 1975 until the mid-1980s, the decontamination room was maintained in standby status and operated periodically. From the mid-1980s to February 1990, the facility was maintained in reserve status but was not used. The sump currently manages liquid waste residual that has been characterized as hazardous (see Section 3).

2.2.4.2 *Valve Pit #1.* Valve Pit #1 (TAN-1704; 98TAN00414) contains piping that transferred low-level radioactive waste from Valve Pit #2, TAN-607, TAN-649, and the TAN-616 sumps to the sump tank (V-9). The waste transferred from Valve Pit #2 and TAN-616 was determined to have been hazardous. The dimensions of the valve pit are: 1.5 m (5 ft) by 1.6 m (5.3 ft) by 2.9 m (9.5 ft) in depth. The calculated internal volume of the valve pit is 1,895 gal (INEEL 2001a). The valve pit served as ancillary equipment to waste lines that transferred hazardous waste (see Table 2-1) and may have been contaminated by leakage from the valves located in the pit.

Valve Pit #1 effluent lines (3” A2-101 and 6” A2-102) discharged to Sump Tank V-9 (FFA/CO Site TSF-18). The lines have been cut and capped inside the valve pit. During a 2001 inspection, approximately 1 ft of water (approximately 200 gal), presumably rainwater or snow melt infiltration, was noted in the bottom of the valve pit.

2.2.4.3 *TAN-615 East Pit/Sump.* The TAN-615 east pit/sump (98TAN00409) was configured to discharge directly to Collecting Tank V-3 (FFA/CO Site TSF-09). The sump is 2.4 m (8 ft) by 4.3 m (14 ft) by 2.4 m (8 ft) in depth (11 ft 9 in. for the pit/sump depth). The east pit was also known as the actuator pit. It was used for control rod drive mechanism tests for Loss-of-Fluid Test fuel assemblies (INEEL 2001a). The pit/sump contained a small amount of residual material that was determined to exhibit the toxicity characteristic for metals (see Section 3). The waste in the sump was removed, the sump was decontaminated, and waste was disposed of as hazardous, in accordance with EDF-2167 as a VCO interim action. Documentation of all waste removal activities and subsequent characterization and disposal will be included in the PE certification for the partial closure of this tank system.

2.2.4.4 *Pump Room Sump.* The TAN-616 pump room sump (98TAN00651) was used to provide containment and collection of potential leakage in the TAN-616 pump room. A steam eductor (jet) was used to transfer liquids to piping in Valve Pit #1, which subsequently discharged to the sump tank (V-9) and to the collecting tanks (V-1, -2, and -3). The concrete sump is 0.6 m (2 ft) in length, 0.6 m (2 ft) in width, and 0.5 m (1.5 ft) in depth. There are no records of liquid in the pump room sump, either during facility operation or after the facility was inactivated. The pump room sump was noted as dry and contained a layer of sediment in the bottom during entries in October 2000. The sump functioned as part of the secondary containment system for transfer equipment located in the pump room and it potentially collected leakage from this equipment. Approximately 1 ft^3 of sediment was removed from this sump as an interim action under the VCO in September 2002. Documentation of all waste removal activities and subsequent characterization and disposal will be included in the PE certification for the partial closure of this tank system.

2.2.4.5 *Evaporator Pit Sump.* The evaporator pit sump (98TAN00419) was used to provide containment and collection of potential leakage in the TAN-616 evaporator pit. A steam eductor (jet) was used to transfer liquids to piping in Valve Pit #1 (TAN-1704), which subsequently discharged to the sump tank (V-9) and to the collecting tanks (V-1, -2, and -3). The concrete sump is 0.6 m (2 ft) in length, 0.6 m (2 ft) in width, and 0.5 m (1.5 ft) in depth. The evaporator pit sump was noted to have contained liquid (presumably infiltration) during 1994 entries (Olaveson et al. 1994). The liquid present in the evaporator pit sump in 1994 is thought to have resulted from precipitation infiltration before the roof was repaired in fall 1993 (Evans and Perry 1993). The evaporator pit sump received process waste releases during facility operation. The evaporator vessel reportedly failed twice during operation and leaked process waste onto the evaporator pit floor. The quantities of hazardous waste released and amounts that reached the sump during facility operation are unknown. The evaporator pit sump was dry and full of sediment during entries in December 2000 and January 2001.

2.2.5 Miscellaneous Components

2.2.5.1 Lead Shielding. There are several irregularly shaped lead sheets on the floor of the evaporator pit that are currently providing shielding, presumably for residual radioactive contamination associated with the concrete floor beneath the lead sheets. The lead shielding will be removed during closure activities to allow access to the contaminated concrete beneath it and will be managed as a hazardous waste upon generation.

2.2.5.2 Floor Sink. The floor sink is located in the TAN-616 operating pump room and was used to collect drainage from the pump priming vacuum system installed in 1974. The floor sink would have collected any hazardous waste liquid transferred from the collecting tanks (V-1, -2, and -3) through the hold tank (15 gal) and vacuum pump and allowed the liquid to drain by gravity to the pump room sump. The floor sink may have been used to manage hazardous waste from 1974 until sometime before 1981.

2.2.6 VCO Actions for Piping Not Included as Part of this Closure

Buried piping identified in Table 2-2, which is outside TAN building footprints, will be evaluated as a follow-on VCO milestone. This piping ceased management of waste before 1980 that would have been defined as hazardous after the promulgation of RCRA. The piping was either gravity-drained and inactive before 1980 or only managed nonhazardous waste after 1980.

Table 2-2. Lines for which the direct-buried portions outside building footprints are subject to evaluation for HWMA/RCRA-required actions.

Reference Number	Description	INEEL Line Number
*3009	TAN-607 Laboratory Drain Header	3” HDA-10031
*3012	TAN-607 Hot Shop Drain Header	6” HDA-10030
*3016	TAN-607 Room 101 (Hot Shop) Sump Drainline	N/A
*3017	TAN-607 Room 101 (Hot Shop) Sump Drainline	N/A
*3018	TAN-607 Warm Shop Drain Header	6” HDA-10029
*3025	TAN-633 Hot Cell Annex Drainline	N/A
*3026	TAN-633 Hot Cell Annex Drainline	N/A
*3027a	TAN-633 Hot Cell Annex Drain Header	3” WDA-10024
*3027b	TAN-633 Hot Cell Annex Drain Header	3” WDA-10024
*3031	TAN-633 Hot Cell Annex Waste Diversion Drainline	N/A
*3058a, b, c	TAN-616 Condensate Discharge Header	4” WDC-10021
*3060b	TAN-616 Evaporator Bottoms Transfer Line	4” HDA-10034
*3061b	TAN-616 Evaporator Bottoms Transfer Line	4” HDA-10033
*3062	TAN-616 Evaporator Bottoms Transfer Line	N/A

The piping that will be evaluated is shown in yellow on Schematics P-CLOS-NEW-TAN-008-616A (Figure 1-1) and P-CLOS-NEW-TAN-008-616B (Figure 1-2). For further information regarding this piping, see the system identification document (INEEL 2001a) and EDF-2333.

The VCO follow-on activities will evaluate potential for past releases and may include sampling and/or visual evaluation. The specific actions that will be taken to address this piping will be agreed to when the milestone is established. The milestone and requirements will be negotiated as part of the VCO process, separate from this closure plan. Addressing these lines as a subsequent VCO milestone is not a criterion for certification of the ILRW Treatment Subsystem closure and this piping is not addressed further in this partial closure plan.

3. TAN-616 TANK SYSTEM CURRENT AND MAXIMUM WASTE INVENTORIES AND CHARACTERISTICS

3.1 Current and Maximum Waste Inventories

Table 3-1 lists each ILRW Treatment Subsystem unit that was determined to have managed hazardous waste, the current and maximum waste inventories of each unit, and the applicable EPA HWNs.

Table 3-1. Waste inventory and EPA HWNs resulting from characterization of ILRW Treatment Subsystem units.

	Type of Waste	Pre-Closure Waste Inventory	Maximum Capacity (gal)	EPA Hazardous Waste Numbers
Head Tank (V-5 [*1011])	Sediment	~2 ft^3	1,000	F001[a]
Hold Tank (15 gal) [*1016]	N/A	0	15	F001[a]
TAN-607 Decontamination Room Sump [*1001]	Liquid	Residual	600	F001, D008, D009[b]
Pump Room Sump [*1020]	Sediment	~1 ft^3 [c]	37	F001, D008, D009[d]
Evaporator Pit Sump [*1021]	Sediment	37 gal[e]	37	F001, D006, D008[a]
Valve Pit #1 (TAN-1704, [*1003])	Liquid	200 gal	1,895	F001[b]
TAN-615 East Pit/Sump [*1010]	Sediment	0[f]	6,700	D006, D008[g]

a. EDF-2879.

b. EDF-2333.

c. The contents of the pump room sump were removed and managed appropriately as an interim action under the VCO in September 2002.

d. The waste in the pump room sump was initially characterized in EDF-2879 as being hazardous with the applicable waste codes being F001 and D008. During interim action waste removal activities, mercury was discovered in the sump and the appropriate waste code (D009) has been assigned to the waste.

e. INEEL 2001b.

f. The TAN-615 east pit/sump contained only a small amount of residual material, which has been removed and managed appropriately as an interim action under the VCO.

g. EDF-2167.

3.2 Waste Sources and Characteristics

Based on sampling data and process knowledge, HWNs are applicable to the subsystem as specified in Table 3-1. Trichloroethene (TCE) was used for its solvent properties in the TAN-607 Decontamination Room, at concentrations that made it a listed waste once disposed as spent liquid. The disposal of spent TCE to the decontamination room sump, and pumping of the sump, resulted in the application of the F001 listed HWN to the decontamination room sump and downstream units specified in Table 3-1. Piping used to convey the waste from the decontamination room sump also carries the F001 listed HWN.

The application of the toxicity characteristic (40 CFR 261.24) HWNs for the specified metals, cadmium (D006), lead (D008), and mercury (D009) (as indicated in Table 3-1), is based upon analytical data from sampling of the sump and tank contents. Further information about the characterization of the units in the ILRW Treatment Subsystem can be found in the applicable EDFs (EDF-2167; EDF-2333; EDF-2879).

4. CLOSURE OF THE ILRW TREATMENT SUBSYSTEM

This section specifies the activities required to comply with the closure performance standard (IDAPA 58.01.05.009 [40 CFR 265.111]) for the ILRW Treatment Subsystem and provides details as to how these activities will be completed.

The closure performance standards identified in IDAPA 58.01.05.009 (40 CFR 265.111) are:

1. The owner or operator must close the facility in a manner that minimizes the need for further maintenance (IDAPA 58.01.05.009 [40 CFR 265.111(a)]).

2. The owner or operator must close the facility in a manner that controls, minimizes, or eliminates to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere (IDAPA 58.01.05.009 [40 CFR 265.111(b)]).

3. The owner or operator must close the facility in a manner that complies with the closure requirements of this subpart, including, but not limited to, the requirements of 40 CFR 265.197, 265.228, 265.258, 265.280, 265.310, 265.351, 265.381, 265.404, and 264.1102 (IDAPA 58.01.05.009 [40 CFR 265.111(c)]).

4.1 Activities to Achieve Compliance with the Closure Performance Standard

4.1.1 Standard 1

- Standard 1: The owner or operator must close the facility in a manner that minimizes the need for further maintenance (IDAPA 58.01.05.009 [40 CFR 265.111(a)]).

The activities required to minimize further maintenance of the ILRW Treatment Subsystem are:

1. Remove waste inventory (Section 4.1.1.1)

2. Remove to the extent practical all system components (Section 4.1.1.2).

4.1.1.1 Remove Waste Inventory. Six of the units included in the ILRW Treatment Subsystem HWMA/RCRA closure contained pre-closure inventories of waste as described in Table 3-1. Information related to the characterization and disposal of the hazardous waste inventory from each of the six units will be included in the PE certification for the closure of this tank system.

The waste inventory contained within the TAN-616 pump room sump has been removed from the pump room sump as a VCO interim action. This waste has been managed as specified in Section 4.2 of this closure plan.

A small amount of residual material was contained within the TAN-615 east pit/sump (98TAN00409 [*1010]). This material has been removed as an interim action under the VCO. The TAN-615 east pit/sump had residual sediment in the bottom that displayed the characteristic of toxicity for lead and cadmium. The residual sediment was managed as specified in Section 4.2 of this closure plan.

The TAN-616 evaporator pit sump (98TAN00419 [*1021]) and the head tank (V-5; 98TAN00427 [*1011]) currently contain sediment. This material will be removed using standard industrial practices (hand tools, vacuum, etc.) and managed as discussed in Section 4.2.

The TAN-607 decontamination room sump (01TAN00001 [*1001]) and Valve Pit #1 (TAN-1704; 98TAN00414 [*1003]) currently contain residual aqueous waste. This liquid will be pumped or removed using suitable liquid removal equipment and managed as discussed in Section 4.2.

Any contents within the lines between the TAN-616 building and Tanks V-1, V-2, and V-3 will be removed as part of the TSF-09 remedial action and managed under CERCLA with the contents of these tanks. Any contents within line 104-A2-6”, located inside TAN-616, will also be removed and managed under CERCLA as part of the contents removal for Tanks V-1, V-2, V-3, and V-9 (FFA/CO Sites TSF-09 and TSF-18). Any liquids found in lines 2” WDA-10027, 4” WDA-10023, or 2” 901-A2 will be managed under closure as discussed in Section 4.2.

4.1.1.2 Remove System Components. When practical, the closure approach for system components and concrete structures is removal and subsequent off-Site disposal. The majority of the components associated with the tank system that are subject to HWMA/RCRA closure will be removed in lieu of decontamination. A specific list of the components that will be removed during closure is provided in Table 4-1. These components will be removed using standard industrial practices and subsequently disposed of as described in Section 4.2. Removal of concrete structures associated with the ILRW Treatment Subsystem (e.g., the TAN-616 building structure) is possible in this instance because D&D activities are being performed concurrently with closure activities.

The TAN-616 building, including tank system components, the evaporator pit walls, and the pump room and evaporator pit sumps and floors, will be removed. The piping and ancillary equipment identified in Table 4-1, the floors of the evaporator pit and pump room, and the evaporator pit walls to a height of approximately 2 ft (estimated height of waste staining on the pit walls; to be field verified) will be removed as part of HWMA/RCRA closure and managed as closure-derived waste in accordance with Section 4.2 of this closure plan. The remainder of the equipment and structure will be removed and disposed of as part of the concurrent D&D activities. Removal and disposition of components and structures not subject to HWMA/RCRA closure is not a criterion for closure certification of the tank system.

Table 4-1. ILRW Treatment Subsystem components that will be removed during closure.

Reference Number	Description	INEEL Unit Number
*1003	Valve Pit #1	TAN-1704
*1011	Head Tank	V-5
*1016	Hold Tank (15 gal)	N/A
*2001	Decontamination Room Sump Pump	SP-201B
*2004	Process Pump	P-1
*2005	Process Pump	P-1A
*2011	Evaporator Discharge Jet	J-6
*2015	Hold Tank (15 gal) Vacuum Pump	N/A
*2017	Pump Room Sump Jet	J-5
*2018	Evaporator Pit Sump Jet	J-4
*3021a	TAN-607 Decontamination Room Sump Discharge Line [a]	2” WDA-10027

Table 4-1. (continued).

Reference Number	Description	INEEL Unit Number
*3021c	TAN-607 Decontamination Room Sump Discharge Line [a]	2" WDA-10027
*3022	TAN-607 Decontamination Room Sump Discharge Line (TAN-666 Construction Cross-Tie) [a]	N/A
*3029b	Replacement Valve Pit #2 – Valve Pit #1 Drainline	4" WDA-10023
*3029c	Replacement Valve Pit #2 – Valve Pit #1 Drainline	4" WDA-10023
*3032a	Valve Pit #1 – Sump Tank (V-9) Drainline	3" A2-101
*3033a	Valve Pit #1 – Sump Tank (V-9) Drainline	6" A2-102
*3034b	Sump Tank (V-9) – TAN-616 Drainline	6" A2-104
*3037a	Collecting Tank (V-1) Feed Line	6" A2-104
*3038a	Collecting Tank (V-2) Feed Line	6" A2-104
*3039a	Collecting Tank (V-3) Feed Line	6" A2-104
*3040b	Collecting Tank (V-1) Suction Line	4" A2-105
*3041b	Collecting Tank (V-2) Suction Line	4" A2-105
*3042b	Collecting Tank (V-3) Suction Line	4" A2-105
*3043	Process Pump Inlet Header	4" A2-105
*3044	Process Pump Discharge Line/Collecting Tank Return Line	N/A
*3045a	Collecting Tank (V-1) Return Line	4" A2-106
*3046a	Collecting Tank (V-2) Return Line	4" A2-106
*3047a	Collecting Tank (V-3) Return Line	4" A2-106
*3048	Head Tank (V-5) Charge Line	3" A2-107
*3049	Head Tank (V-5) Overflow Line	4" A2-118/ 4" A2-117/4" A2-119
*3050	Head Tank (V-5) Discharge Line	2" A2-108
*3059	TAN-616 Evaporator (V-7) Bottoms Discharge Header	4" A2-123
*3070a	Vacuum System Pump Priming Line	N/A
*3070b	Vacuum Pump Inlet Line	N/A
*3070c	Vacuum Pump Drainline	N/A
*3071	Floor Sink Drainline	N/A
*3079	Pump Room Sump Discharge Line	1" A2-901
*3080	Evaporator Pit Sump Discharge Line	1" A2-901
*3081	TAN-616 Sump Discharge Header	2" A2-901
*3098	Evaporator Header Return Line	2" A2-120
*3099	Evaporator Bypass Line	4" A2-122
N/A	New 2-in. Piping in TAN-616	N/A
N/A	New Transfer Pumps	N/A
N/A	Lead Sheets	N/A

a. Should small portions of this line prove technically impracticable to remove, these portions will be decontaminated in accordance with Section 4.1.2.

The decontamination room sump discharge line (2" WDA-10027; *3021a, *3021c, *3022) will be removed to the extent technically practicable. Should technical, radiation exposure, health and safety, or engineering issues prevent the removal of small portions of the line, these portions will be decontaminated as specified in Section 4.1.2. Any other component for which removal is shown based on field conditions to be impractical may be decontaminated as specified in Section 4.1.2.2.

4.1.2 Standard 2

- Standard 2: The owner or operator must close the facility in a manner that controls, minimizes or eliminates to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere (IDAPA 58.01.05.009 [40 CFR 265.111(b)]).

The activities required to minimize or eliminate to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or the atmosphere are:

1. Remove waste inventory (addressed under Standard 1; Section 4.1.1.1)

2. Remove to the extent practical all system components (addressed under Standard 1; Section 4.1.1.2)

3. Decontaminate piping that will not be removed (Section 4.1.2.2)

4. Decontaminate the decontamination room sump (Section 4.1.2.3).

4.1.2.1 Decontamination Strategy. In general, components will be removed wherever practical in lieu of decontamination. Components that will require decontamination include the stainless steel-lined decontamination room sump and associated stainless steel piping.

Components will be decontaminated using common industrial practices to remove hazardous waste residuals to the extent necessary to meet the specified closure performance criteria. Units and components that are successfully decontaminated to the specified closure performance standard criteria will not have listed HWNs associated with them. Following preliminary decontamination, the component will be rinsed with water. Water is considered to be an appropriate decontamination solution for several reasons:

- The introduction of additional hazardous components (i.e., acid) to the system is undesirable

- Water is the medium that transported the contaminants of concern (COCs) into the system

- Water is representative of potential leaching liquid that would contact the system under a tank system closure scenario.

Before rinsing, an integrity evaluation will be performed for components requiring decontamination to ensure that there have been no releases to the subsurface as a result of previous operational activities and to minimize the potential for release during closure activities.

The components will be decontaminated until site-specific action levels have been achieved. TAN-607 Decontamination Room-specific COCs and action levels that will be used for determining the effectiveness of decontamination of the lined sump and associated piping are presented in Table 4-2. A detailed discussion of the identification of COCs and development of action levels is included in Appendix A. Action levels were developed by modeling the constituent release mechanism of water contacting the decontaminated components and subsequently being released to the surrounding soil. Because the only viable pathway to potential receptors identified in the risk-based methodology is water contacting decontaminated piping, it is appropriate to collect rinsate samples from the piping internal surfaces to demonstrate compliance with the closure performance standard. The calculated decontamination room-specific action levels apply only to steel components that managed TAN-607 decontamination room sump waste. The calculations presented in Appendix A are separate from the risk assessments that will be performed for soil, which, if necessary, will be performed as described in Appendix B.

It is appropriate to use historical data from the sampling of the decontamination room sump for purposes of identification of COCs and action levels for steel components that only managed this waste stream. The decontamination room-specific COCs and action levels identified in Table 4-2 apply to only those components that solely managed waste from the decontamination room and were not co-mingled with waste from other sources. If, during post-decontamination sampling, additional COCs are identified, action levels will be developed for the additional constituents using the methodology outlined in Appendix A. Any component for which decontamination is shown, based on field conditions, to be impractical, may be removed and disposed of in accordance with Section 4.2.

To confirm that bulk hazardous waste has been removed from decontaminated components, visual or remote video inspections of decontaminated equipment will be completed following successful decontamination.

Decontamination will also be required for closure equipment (i.e., tools, heavy equipment, etc.) that has come into contact with hazardous waste and that will be reused. Only equipment that will have come into direct contact with hazardous waste will require decontamination for hazardous constituents. Project logs will be maintained that document all equipment that has contacted hazardous waste. The exterior surface of equipment will be decontaminated to display a clean visible surface prior to being reused. The method and result of decontamination of all equipment will be documented and maintained as part of the project record. Decontamination residue will be managed based on an applicable HWD and managed in accordance with Section 4.2.

4.1.2.2 Decontaminate Piping. Steel piping requiring closure activities will be removed to the extent technically practicable. The majority of the TAN-607 decontamination room sump discharge line (that located outside the TAN-607 building footprint) will be removed. If removal of portions of the piping is deemed impractical, these portions will be decontaminated. This section pertains to the inlet piping to the decontamination room sump and small segments of the decontamination room sump outlet line that cannot be removed due to technical, engineering, radiological exposure, or health and safety reasons. This will include, at a minimum, the portions of piping associated with the TAN-607 decontamination room sump that are within the footprint of TAN-607.

Table 4-2. TAN-607 Decontamination Room-specific contaminants of concern and action levels.

Constituent of Concern	CAS No.	Action Level (mg/L)	Total Risk	Total Hazard Quotient
Barium	7440-39-3	5.93E+01	—	3.32E-04
Cadmium	7440-43-9	5.99E-01	1.51E-12	4.69E-04
Chromium^{6+}	7440-47-3	2.93E+00	3.40E-10	3.84E-04
Copper	7440-50-8	1.48E+03	—	1.45E-02
Lead	7439-92-1	2.50E+00	—	—
Mercury	7487-94-7	1.20E-01	—	1.56E-04
Nickel	7440-02-0	1.05E+03	—	2.05E-02
Silver	7440-22-4	3.00E+00	—	2.35E-04
Zinc	7440-66-6	4.05E+03	—	5.28E-03
Cyanide (Total)	57-12-5	2.09E+01	—	4.09E-04
1,1-Dichloroethene	75-35-4	4.20E-01	—	3.29E-06
1,2-Dichlorobenzene	95-50-1	2.22E+02	—	9.65E-04
cis-1,2-Dichloroethene	156-59-2	8.70E+01	—	3.40E-03
1,3-Dichlorobenzene	541-73-1	3.70E+01	—	1.61E-02
1,4-Dichlorobenzene	106-46-7	4.06E+00	1.36E-08	5.30E-05
2-Butanone	78-93-3	1.19E+02	—	7.78E-05
Dichlorodifluoromethane	75-71-8	1.84E+02	—	3.59E-04
Ethylbenzene	100-41-4	1.16E+01	6.23E-09	4.53E-05
Methylene Chloride	75-09-2	1.16E+01	1.22E-08	7.58E-05
Tetrachloroethene	127-18-4	4.16E-01	3.03E-09	1.63E-05
Toluene	108-88-3	3.01E+02	—	5.88E-04
Trichloroethene	79-01-6	1.09E-01	6.09E-09	1.42E-04
1,2,4-Trichlorobenzene	120-82-1	7.39E+02	—	2.89E-02
Acenaphthene	83-32-9	1.81E+03	—	1.18E-02
Benzo(a)anthracene	56-55-3	8.41E-01	8.58E-08	—
Benzo(a)pyrene	50-32-8	1.24E-01	1.27E-07	—
Benzo(b)fluoranthene	205-99-2	1.18E+00	1.20E-07	—
Butylbenzylphthalate	85-68-7	3.31E+03	—	6.47E-03
Chrysene	218-01-9	1.47E+01	1.50E-08	—
Diethylphthalate	84-66-2	6.61E+03	—	3.24E-03
Di(n)octylphthalate	117-84-0	1.48E+03	—	1.45E-02
Fluoranthene	206-44-0	1.48E+03	—	1.45E-02
Fluorene	86-73-7	1.48E+03	—	1.45E-02
Naphthalene	91-20-3	1.10E+02	—	2.15E-03
Phenol	108-95-2	5.73E+03	—	3.74E-03
Pyrene	129-00-0	1.28E+03	—	1.67E-02
Total			3.89E-07	1.80E-01

A list of piping ancillary to the decontamination room sump that requires decontamination by rinsing is provided in Table 4-3. Piping requiring decontamination associated with the TAN-607 decontamination room sump will be: (1) decontaminated or cleaned to remove residual waste/debris, (2) rinsed with water and final rinsates sampled in accordance with the field sampling plan (FSP) (INEEL 2003) and analyzed for TAN-607 decontamination room-specific COCs, (3) the resulting analytical data will be compared with the TAN-607 decontamination room-specific action levels to demonstrate successful decontamination of the piping, and (4) the piping system will be video inspected to demonstrate that bulk hazardous waste has been removed from the system, as described below.

Prior to rinsing, piping that will be decontaminated will undergo an integrity evaluation to ensure that there have been no releases to the subsurface as a result of previous operational activities and to minimize the potential for release during closure activities. If a visual evaluation is performed, the evaluation will be completed by remotely inspecting the line. Other methods of integrity evaluation may also be used, as appropriate, to demonstrate the integrity of the piping, including process knowledge obtained from the results of the pressure test on the portions of line 2" WDA-10027 that are outside the footprint of TAN-607. The results of the integrity evaluation will be included in the closure certification.

Embedded piping within and below the TAN-607 footprint and other piping that cannot be removed will be inspected, as technically practicable, using direct visual inspection or remote video inspection techniques to determine if bulk hazardous waste remains in the piping system following decontamination. Normal scaling associated with liquid waste piping systems and residual staining may be present. Small amounts of residue and particles may also be present within the piping provided that such residues and/or particles do not exceed 5% of the volume of any 1-ft piping length. Should it be determined, based on the inspection, that bulk hazardous waste has not been removed from the system, more aggressive water-based decontamination methods (e.g., high-pressure wash, steam, etc.) may be employed.

Following decontamination, rinsate sampling, and video inspection, the discharge piping from the decontamination room sump [*3021a] will be plugged or capped both inside and outside TAN-607 to minimize the potential for the post-closure escape of hazardous constituents.

Table 4-3. Piping ancillary to the decontamination room sump that will require decontamination by rinsing.

Reference Number	Description	INEEL Unit Number
*3020	TAN-607 Decontamination Room Waste Collection Piping	N/A
*3021a, *3021c, *3022	TAN-607 Decontamination Room Sump Discharge Line[a]	2" WDA-10027

a. Only small portions of this line that cannot be removed in accordance with Section 4.1.1 due to technical, engineering, or health and safety issues will be decontaminated. At a minimum this is expected to include the portion of the discharge line located beneath the TAN-607 footprint.

4.1.2.3 Decontaminate Decontamination Room Sump. The decontamination room sump [*1001] will be decontaminated to the TAN-607 Decontamination Room-specific action levels and visually inspected to confirm that bulk hazardous waste does not remain within the sump. Decontamination of the sump will consist of the following: (1) removing waste residuals from the sump, (2) stripping the paint from the sump liner, (3) rinsing the sump liner with water to remove any residual material, (4) collecting final rinsate samples in accordance with the FSP (INEEL 2003) for analysis for the TAN-607 Decontamination Room-specific COCs, (5) comparing the resulting analytical data with the TAN-607 Decontamination Room-specific action levels to demonstrate successful decontamination of the sump, and (6) visual inspection of the sump to confirm that bulk hazardous waste has been removed from the sump.

Prior to rinsing, the TAN-607 decontamination room sump [*1001] will be evaluated for integrity using one of two methods. Following removal of the paint covering the stainless steel liner, the liner will be visually inspected by qualified INEEL quality assurance personnel to confirm the integrity of the sump. The following criteria will be used for the inspection:

- No visible holes or cracks shall be present in the liner
- No cracks shall be present in any of the welds
- The welds shall have no more than one visible pore or inclusion no longer than 0.5*t in any 1-in. (25 mm) segment of the weld, where "t" equals the thickness of the thinner member
- The welds shall have no more than three visible pores or inclusions no larger than 0.25*t in any 1—in. (25mm) segment of the weld.

Alternatively, the sump may be subjected to a standing water test to demonstrate that the liner is intact. Other integrity evaluation methods may be used, if necessary, to demonstrate that the liner is intact. Whatever method is selected, the results of the test will be included in the closure certification. If the integrity of the sump liner cannot be confirmed, this plan will be amended in accordance with Section 6 to address potentially contaminated concrete and soils beneath the sump.

The TAN-607 decontamination room sump will be visually inspected following decontamination to ensure that bulk hazardous waste has been removed from the sump. Normal scaling associated with liquid waste systems and residual staining may be present. Small amounts of residue and particles may also be present within the sump provided that such residues and/or particles do not exceed 1% of the volume of the sump. Should it be determined, based on the inspection, that bulk hazardous waste has not been removed from the system more aggressive water-based decontamination methods (e.g., high-pressure wash, steam, etc.) may be employed.

4.1.3 Standard 3

- Standard 3: The owner or operator must close the facility in a manner that complies with the closure requirements of this subpart, including, but not limited to, the requirements of 40 CFR 265.197, 265.228, 265.258, 265.280, 265.310, 265.351, 265.381, 265.404, and 264.1102 (IDAPA 58.01.05.009 [40 CFR 265.111(c)]).

As the ILRW Treatment Subsystem is a tank system, it is subject to the closure requirements specified at 40 CFR 265.197. The tank system closure requirements (as quoted from IDAPA 58.01.05.009 [40 CFR 265.197]) are:

1. At closure of a tank system, the owner or operator must remove or decontaminate all waste residuals, contaminated containment system components (liners, etc.), contaminated soils, and structures and equipment contaminated with waste, and manage them as hazardous waste, unless §261.3(d) of this Chapter applies. The closure plan, closure activities, cost estimates for closure, and financial responsibility for tank systems must meet all of the requirements specified in subparts G and H of this part (IDAPA 58.01.05.009 [40 CFR 265.197(a)]).

2. If the owner or operator demonstrates that not all contaminated soils can be practicably removed or decontaminated as required in paragraph (a) [Requirement 1] of this section, then the owner or operator must close the tank system and perform post-closure care in accordance with the closure and post-closure care requirements that apply to landfills (§265.310). In addition, for the purposes of closure, post-closure, and financial responsibility, such a tank system is then considered to be a landfill, and the owner or operator must meet all of the requirements for landfills specified in subparts G and H of this part (IDAPA 58.01.05.009 [40 CFR 265.197(b)]).

3. If an owner or operator has a tank system which does not have secondary containment that meets the requirements of §265.193 (b) through (f) and which is not exempt from the secondary containment requirements in accordance with §265.193(g), then,

   (a) The closure plan for the tank system must include both a plan for complying with paragraph (a) [Requirement 1] of this section and a contingent plan for complying with paragraph (b) [Requirement 2] of this section.

   (b) A contingent post-closure plan for complying with paragraph (b) [Requirement 2] of this section must be prepared and submitted as part of the permit application.

   (c) The cost estimates calculated for closure and post-closure care must reflect the costs of complying with the contingent closure plan and the contingent post-closure plan, if these costs are greater than the costs of complying with the closure plan prepared for the expected closure under paragraph (a) [Requirement 1] of this section.

4.1.3.1 Plan for Closure in Compliance with §265.197(a) [Requirement 1]. The activities required to close the tank system in accordance with 40 CFR 265.197(a) are:

1. Remove waste inventory (addressed under Standard 1; Section 4.1.1)

2. Remove to the extent possible all system components (addressed under Standard 1; Section 4.1.1)

3. Decontaminate piping that will not be removed (addressed under Standard 2; Section 4.1.2)

4. Decontaminate the decontamination room sump (addressed under Standard 2; Section 4.1.2)

5. The decontamination room sump and associated piping embedded within or located beneath the TAN-607 structure will be visually inspected to ensure that bulk hazardous waste has been removed from the system (addressed under Standard 2; Section 4.1.2)

6. Soils associated with direct-buried piping will be addressed by performing an integrity evaluation (see Sections 4.1.2.2 and 4.1.2.3) to demonstrate that no release to the environment has occurred and, therefore, soil sampling is not required. Soil samples will be collected if integrity cannot or will not be verified.

<u>Soils within established FFA/CO sites</u>. In general, soils associated with components located within established FFA/CO sites will be sampled. Two FFA/CO sites have been identified that include soils associated with equipment undergoing closure. These sites are shown on Schematic P-CLOS-NEW-TAN-008-616B (Figure 1-2) and include:

- TSF-09/18: Location surrounding the collecting tanks (V-1, -2, and -3) [*1006, *1007, and *1008] and the sump tank (V-9) [*1004] – Buried hazardous waste management piping addressed in this closure plan is located within the area of potential contamination for this site

- TAN-616: Soils beneath and surrounding TAN-616.

Soils associated with components undergoing closure that are included within the boundaries of one of the established FFA/CO sites (lines 4" WDA-10023 and 2" 901-A2, a portion of line 2" WDA-10027, the pump room, and the evaporator pit), as shown on Schematic P-CLOS-NEW-TAN-008-616B (Figure 1-2), will be subject to characterization under HWMA/RCRA closure once removal of these components is completed. Remedial investigation and/or remedial activities with respect to these soils will be completed under the provisions of the FFA/CO. Completion of these FFA/CO activities will not be a criterion for closure certification. Provisions for sampling and analysis of these soils under HWMA/RCRA closure are included as Subunit 1 in the FSP (INEEL 2003). Soil samples will be collected from beneath TAN-616 following removal of the concrete within the timeframe specified in the schedule identified in Section 5. A summary of the validated analytical data resulting from the sampling specified in the FSP will be included in the PE certification for closure of the ILRW treatment subsystem.

Line 2" WDA-10027 [*3021a and *3021c], the TAN-607 decontamination room sump discharge line, passes beneath surficial soil contamination sites (not shown on Schematic P-CLOS-NEW-TAN-008-616B [Figure 1-2]) that are identified on the FFA/CO:

- TSF-06 (Area 11): Ditch

- TSF-06 (Area 1 and Area B): Soil area south of turntable

- TSF-08: Mercury spill area.

The contamination zones for these sites are surficial in nature (DOE-ID 1997). This waste line is buried at a depth of approximately 5 ft (Paige 1972). Because these sites are surficial contamination sites and are not related to the buried waste line, the soils beneath the portions of the line that cannot be confirmed intact will be characterized as part of this closure and managed as described below (i.e., characterized as though they are not within an established FFA/CO site). As the contaminated surficial soils are unrelated to the equipment undergoing closure, and are being managed under the provisions of the FFA/CO, no remedial activities related to the known surficial soil contamination will be conducted under closure.

An integrity evaluation may be performed on lines 4" WDA-10023 and 2" 901-A2 to assess the potential for release to the subsurface as a result of previous operational activities. If a pressure test is used, it will be completed using an appropriate methodology for the pressure testing of piping. If a visual evaluation is performed, the evaluation will be completed by inspecting the line upon its removal. The results of the inspection of the removed piping will be applied to small segments that may be left in place, in the event removal of the entire line is impracticable due to engineering, health and safety, or radiological control issues, provided that the portion of line to be left in place following decontamination is not equipped with devices such as elbows, valves, or flanges that would cause the integrity of this portion to be different from the portions of lines that will be removed. Other methods of integrity evaluation may also be used, as necessary, to demonstrate the integrity of the piping. Whatever method is selected, the results of the test will be included in the PE certification of successful HWMA/RCRA closure of the tank system. No samples of soils associated with components for which integrity is confirmed will be collected, as the successful integrity evaluation will demonstrate that there have been no releases to the environment.

<u>Soils outside established FFA/CO Sites</u>. Soils associated with components not located within an established FFA/CO site will be addressed by performing an integrity evaluation to demonstrate that releases of contaminants to the environment have not occurred. No samples of soils associated with components for which integrity is confirmed will be collected, as the successful integrity evaluation will demonstrate that there have been no releases to the environment. Integrity evaluations will be performed on the decontamination room sump, associated piping, and inlet and discharge piping located beneath the TAN-607 footprint. If the integrity of the decontamination room sump and associated piping cannot be demonstrated, this closure plan will be amended in accordance with Section 6. Soils associated with the portions of line 2" WDA-10027 that cannot be confirmed intact will be sampled as specified in the FSP (INEEL 2003).

An integrity evaluation will be performed on the portions of the TAN-607 decontamination room sump discharge line (2" WDA-10027) that is outside the TAN-607 footprint to assess the potential for release to the subsurface as a result of previous operational activities. If a pressure test is used, it will be completed using an appropriate methodology for the pressure testing of piping. If a visual evaluation is performed, the evaluation will be completed by inspecting the line upon its removal. In the event removal of the entire line is impracticable due to engineering, health and safety, or radiological control issues, t results of the inspection of the removed piping will be applied to small segments that may be left in place. The inspection results will only be applied if the portion of the line to be left in place is not equipped with devices such as elbows, valves, or flanges that would cause the integrity of this portion to be different from the portions of lines that will be removed. Other methods of integrity evaluation may also be used, as necessary, to demonstrate the integrity of the piping. Whatever method is selected, the results of the test will be included in the PE certification of successful HWMA/RCRA closure of the tank system.

The TAN-607 decontamination room sump [*1001] will be evaluated for integrity as specified in Section 4.1.2.3. If the sump liner is confirmed to be intact, no samples of soils associated with the sump will be collected, as the successful integrity evaluation will demonstrate there has been no release from this sump. If the sump cannot be confirmed intact, this closure plan will be amended in accordance with Section 6.

Soils associated with the decontamination room sump and associated discharge line will be characterized as specified in the FSP (INEEL 2003) if portions of this line cannot be confirmed intact. Soils will be sampled following completion of component removal and/or decontamination. Data from soils outside established FFA/CO sites will be used to complete a site-specific risk assessment in accordance with the methodology presented in Appendix B, to determine whether the soils pose a risk to human health or the environment (e.g., excess cancer risk less than 1.0E-06 and hazard quotient (HQ) less than 1).

Due to historical operations at TAN, there is a possibility that soil contamination unrelated to operation of the ILRW Management System may be detected, based either on analytical results or field observations. Only soil that has been contaminated as a result of a release from the ILRW Treatment Subsystem will be addressed under this closure plan. The assessment of the source of any detected soil contamination will be completed based upon proximity of other unrelated equipment or components and the integrity of the components subject to closure activities. Any historical contamination discovered that is unrelated to the system undergoing closure will be addressed using the FFA/CO New Site Identification process; however, approval of the new site by the Agencies is not a criterion for certification of closure. The location and source of the unrelated soil contamination will be documented in the closure certification.

4.1.3.2 Plan for Closure in Compliance with 40 CFR 265.197(b) and (c) [Requirements 2 and 3]. Figure 4-1 provides an overview of how soil data collected during closure will be used and the integration between this HWMA/RCRA closure and the INEEL CERCLA Program. Analytical data for soils located within established FFA/CO sites will be provided to the INEEL CERCLA Program for evaluation as part of ongoing activities under the FFA/CO. No further actions with regard to these soils will be required to certify closure of the TAN-616 tank system. Soils remaining in place after removal or decontamination of components that cannot be confirmed intact and that are not located within the boundaries of one of the established FFA/CO sites, as shown on Schematic P-CLOS-NEW-TAN-008-616B (Figure 1-2), will be characterized as specified in the FSP (INEEL 2003). The analytical data will be used to conduct a site-specific risk assessment(s) in accordance with the methodology presented in Appendix B. The sampling approach identified in the FSP (INEEL 2003) includes the collection of systematic random samples to provide an estimate of the mean COC concentrations in the soils associated with each component (i.e., portions of line 2" WDA-10027 for which integrity cannot be confirmed). The FSP also specifies the collection of biased soil samples in areas of suspected releases. The two types of analytical data will be evaluated as part of the data quality assessment (DQA) process to determine whether the mean COC concentrations in the bias samples exceed the overall population mean. If it is determined through the DQA process that the bias samples are indicative of potential release points, these data will be used separately from the soil data collected from the systematic random sampling and a separate risk assessment(s) will be conducted for the suspected release site(s).

If the risk assessment indicates soil contamination is present that poses a risk to human health, a NSIF under the FFA/CO will be completed to allow investigation of the contaminated soil under the FFA/CO. Approval of this NSIF by the Agencies, including IDEQ and EPA, is a criterion for certification of closure. However, completion of any follow-on activities for these potential new FFA/CO sites is not a criterion for certification of closure. If the NSIF is not approved by the Agencies, the closure plan will be amended in accordance with Section 6 to address the identified soil contamination. If the risk assessment indicates that the soils do not pose a risk to human health, no further actions with regard to the soils will be taken under closure.

The sampling approach identified in the FSP (INEEL 2003) includes the collection of systematic random samples to provide an estimate of the mean COC concentrations in the soils associated with each component (i.e., portions of line 2" WDA-10027 for which integrity cannot be confirmed). The FSP also specifies the collection of biased soil samples in areas of suspected releases. The two types of analytical data will be evaluated as part of the DQA process to determine whether the mean COC concentrations in the bias samples exceed the overall population mean.

Per EDF-2167, the soils beneath the TAN-615 east pit/sump (98TAN00409 [*1010]) have been sampled and a NSIF completed for residual contamination associated with these soils. Upon approval of the NSIF, the TAN-615 sumps will be moved to Appendix C of the VCO – Covered Matters that are Closed. Should the NSIF addressing these soils be disapproved by the Agencies, a risk assessment will be completed for the residual soil contamination in accordance with the provisions of this closure plan. Follow-on actions (i.e., resubmittal of the NSIF) will be determined based upon the results of the site-specific risk assessment.

4.2 Waste Management

A variety of waste streams will be generated during HWMA/RCRA partial closure of the ILRW Treatment Subsystem. Primary waste streams will include the current waste inventory contained within the system as specified in Table 3-1 of this closure plan, the components that are to be removed, and decontamination residue. Closure-derived waste streams will also consist of items such as contaminated personal protective equipment (PPE), sampling equipment, and tools. All waste generated during this closure project, as specified in Table 4-4, will be considered closure-derived waste. All closure-generated wastes will undergo a HWD in accordance with the requirements of IDAPA 58.01.05.006 (40 CFR 262.11). Details as to how specific waste streams are anticipated to be managed are provided in Table 4-4.

The 90-day timeframe stipulated in IDAPA 58.01.05.006 [40 CFR 262.34(a)(1)] will not apply to closure-derived waste staged within the facility being closed. For purposes of this closure, the facility is defined as the TAN-607 decontamination room and the areas directly west and northwest of TAN-607, where system components are located. While closure activities are being conducted, the closure boundaries will be clearly marked. Closure-derived waste will be managed within a demarcated closure area or other permitted storage areas at TAN. Debris treatment may occur within the demarcated closure boundaries without a separate waste analysis plan. All other 40 CFR 262.34(a) requirements will be met. All waste and waste containers will be removed from the demarcated closure area and transferred to RCRA-permitted or interim status storage prior to closure certification. Information regarding waste management during closure activities will be provided to the independent PE for closure certification.

The TAN-616 pump room floor and the evaporator pit floor and walls that show signs of waste-related contamination (i.e., staining), as well as the associated sumps within each room, may be treated to the debris treatment standards of IDAPA 58.01.05.011 (40 CFR 268.45) and disposed of as low-level or industrial waste in lieu of treatment and disposal at a RCRA-permitted treatment, storage, and/or disposal facility.

Decontamination residues (i.e., liquids, rags, etc.) resulting from activities associated with listed waste will be managed as a listed waste and undergo a characteristic HWD evaluation. Decontamination residues from components that only managed waste displaying a hazardous characteristic will undergo a characteristic HWD evaluation. Waste will be disposed in accordance with the results of the HWD for this waste stream.

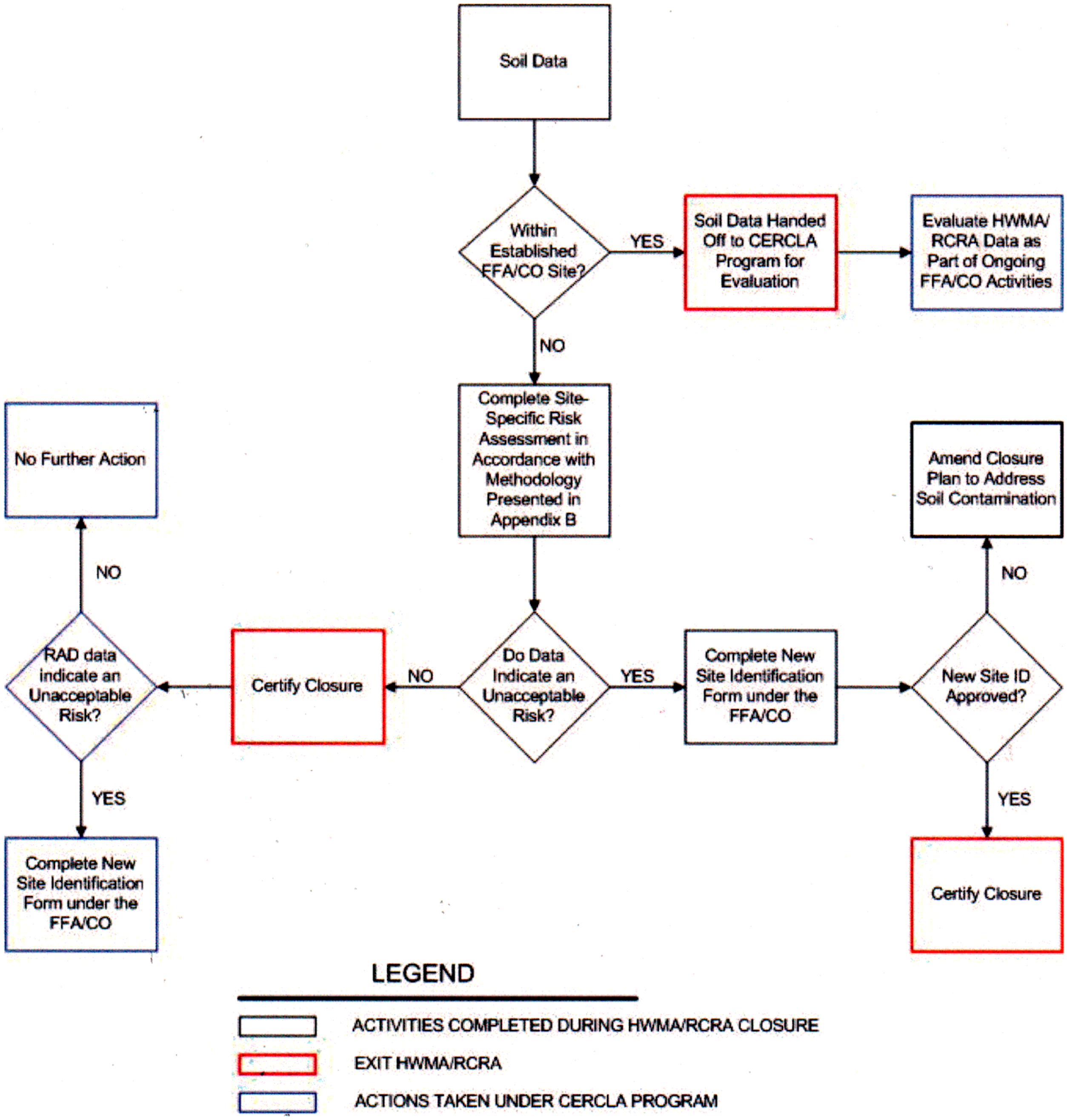

Figure 4-1. Flow path for use of soil data collected during closure of the TAN-616 system.

Table 4-4. Closure-derived waste streams and anticipated disposal pathways.

Waste Stream	Description	Expected EPA Hazardous Waste Number	Disposal Pathway
Process Waste	Evaporator pit sediment	F001, D006, D008	Storage at INTEC-1617 or other INEEL HWMA/RCRA-permitted facility until disposal path is confirmed
Process Waste	Head tank sediment	F001	Storage at INTEC-1617 or other INEEL HWMA/RCRA-permitted facility until disposal path is confirmed
Process Waste	Pump room sediment	F001, D008, D009	Storage at INTEC-1617 or other INEEL HWMA/RCRA-permitted facility until disposal path is confirmed
Process Waste	TAN-615 East pit/sump sediment	D006, D008	Interim Storage at INTEC-1617 prior to off-Site stabilization and disposal at a RCRA-permitted treatment, storage, and disposal facility[a,b]
Process Waste	Decontamination room sump liquid	F001, D008, D009	Storage at INTEC-1617 or other INEEL HWMA/RCRA-permitted facility until disposal path is confirmed
Process Waste	Valve Pit #1 liquid	F001	Storage at INTEC-1617 or other INEEL HWMA/RCRA-permitted facility until disposal path is confirmed
Equipment	Components and lead shielding removed under closure, including that equipment identified in Table 4-1	F001[a]	Storage at INTEC-1617 or other INEEL HWMA/RCRA-permitted facility until disposal path is confirmed
Concrete	TAN-616 concrete contaminated by waste[b]	N/A	Disposal as low-level debris at the Radioactive Waste Management Complex, disposal as industrial debris at the Central Facilities Area Landfill, or disposal as HWMA/RCRA debris at a RCRCA-permitted treatment, storage, and disposal facility [c]
Soils (if applicable)	Soils associated with direct-buried components that may be removed during component removal activities	TBD	To be determined based upon waste stream characterization
Decontamination Residue	Waste resulting from the decontamination of structural concrete and piping	TBD[d]	To be determined based upon waste stream characterization
Decontamination Residue	Spent decontamination solutions resulting from decontamination of steel components	TBD[d]	To be determined based upon waste stream characterization

Table 4-4. (continued).

Waste Stream	Description	Expected EPA Hazardous Waste Number	Disposal Pathway
Secondary waste	Disposable closure equipment (PPE, sampling equipment, etc.)	TBD[d]	To be determined based upon waste stream characterization

a. Lead shielding will, upon removal from the evaporator pit, display the EPA HWN for toxicity for lead (D008).

b. Based on physical inspection of the concrete, waste-related staining has only been evidenced on approximately the bottom 2 ft of the walls of the evaporator pit and pump room. Concrete that does not show signs of waste-related staining will be managed separately under the D&D actions being taken and disposed of based on a HWD.

c. Concrete that shows signs of waste-related staining, as confirmed during closure activities, will be transported to a RCRA-permitted treatment, storage, and disposal facility for treatment and/or disposal or may be treated to the debris treatment standards of IDAPA 58.01.05.011 (40 CFR 268.45) and disposed of as low-level or industrial waste.

d. This waste stream will be characterized for disposal and appropriate EPA HWNs applied. The disposal pathway for this waste stream will be determined based upon the characterization results. The concrete decontamination residue from decontamination of the TAN-615 east pit/sump has been disposed along with the sediment removed from the pit/sump

5. CLOSURE SCHEDULE

IDAPA 58.01.05.009 [40 CFR 265.113(a) and 113(b)] specifies time limits for submitting closure plans, beginning closure, and the removal of all waste from a tank system. The INEEL is requesting an extension to these requirements because waste removal will, of necessity, take longer than 90 days and completion of closure will, of necessity, take longer than 180 days.

Table 5-1 identifies the schedule for performing and completing the closure activities specified in this plan. This schedule reflects the time required for conducting closure activities and submitting information to the PE for the closure certification. If closure activities are completed ahead of schedule, the INEEL will accelerate the closure certification process accordingly. Quarterly reports summarizing closure activity progress will be submitted to the IDEQ by April 30, July 31, October 31, and January 31 of each year. Quarterly progress reporting to IDEQ will commence on the first of the aforementioned dates following Day 0.

Table 5-1. Schedule for closure of the ILRW Treatment Subsystem.

Planned Work Task	Days to Completion
IDEQ approval of closure plan	0
Waste removed from head tank	30
Components removed from evaporator pit	90
Complete removal of all hazardous waste inventory as specified in Table 3-1	210
Complete decontamination of TAN-607 components	250
Complete removal/decontamination of buried piping and Valve Pit #1	300
Complete removal of remaining pump room piping	325
Complete sampling activities specified in the FSP (INEEL 2003)	360
Complete removal of concrete structures	400
Complete closure-generated waste disposition	450
Approval of NSIF for releases associated with system piping located outside established FFA/CO sites	450[a]
Closure activities complete	460[a]
Professional Engineer and owner/operator certification submitted to IDEQ	Within 60 days of completion of closure activities

a. If the NSIF(s) have not been approved by the Agencies by Day 450, the end date for closure activities will automatically be extended until such time as a decision is made by the Agencies on the NSIF(s) and an amendment of the plan will not be required.

Day 0, as specified in Table 5-1, is the date of receipt of IDEQ approval of the closure plan. The removal and disposition of some components as described in Section 4.1.1 of this closure will have occurred prior to the submittal and approval of this closure plan (Day 0). Since removal of wastes and equipment are the most protective measures possible, the closure methods for this equipment are not expected to change as a result of review and approval of the closure plan. Consequently, activities that may occur prior to Day 0 will be consistent with the approved closure plan. Any specified activity may be completed ahead of the schedule shown in support of final facility closure.

IDAPA 58.01.05.009 (40 CFR 265.113) requires waste removal activities to be completed 90 days from the approval of the closure plan and closure to be completed within 180 days from the initiation of the closure. An extension to these time periods, as specified in Table 5-1, is being requested at this time, pursuant to IDAPA 58.01.05.009 (40 CFR 265.113).

An extension is necessary to ensure that all work is conducted in such a manner so as to protect workers from potential hazards associated with work in a high radiation and radiological-contamination environment. All work must be conducted in a manner to prevent release of HWMA/RCRA and radiological constituents to the environment.

The waste contained within TAN-616 components that is currently being removed and managed is radioactive. All work relating to removing, managing, and transporting radioactive mixed waste requires additional time due to the requirements for care in work planning, including radiological work permits. Radioactive waste also presents limitations on the type of work than can be conducted due to the radiation fields (i.e., remote handling may be required).

Removal of the equipment from the evaporator pit requires additional time, as specified in Table 5-1 due to several problems intrinsic to this work environment. The evaporator pit is a radiation area, a contamination area, and a confined space. Hatches atop the pit will require rigging and lifting, imposing special work requirements. Contamination control will be required in the evaporator pit during equipment removal to mitigate the potential spread of contamination. Components removed from the evaporator pit are relatively large and will require rigging and lifting through the roof hatch.

Excavations to remove or facilitate decontamination of buried components must be completed with care due to the presence of large numbers of unrelated buried piping proximate to TAN-616. It is known that water piping, steam piping, electrical conduit, condensate piping, firewater piping, and sanitary sewer lines are all located in the area. Excavations must be completed in such a manner that does not impact the integrity of this piping or place workers in danger due to interaction with energized systems.

6. CLOSURE PLAN AMENDMENTS

The conditions described in IDAPA 58.01.05.009 (40 CFR 265.112), will be followed to implement changes to the approved closure plan. Should unexpected events during the closure period require modification of the approved closure activities or closure schedule, the closure plan will be amended within 30 days of the unexpected event. A written request detailing the proposed changes and the rationale for those changes and a copy of the amended closure plan will be submitted for IDEQ approval. Minor changes to the approved closure plan, which are equivalent to or do not compromise the closure requirements and performance standards identified in the approved closure plan, may be made without prior notification to IDEQ. Minor changes will be identified in the documentation supporting the independent PE certification.

7. CERTIFICATION OF CLOSURE

This partial closure plan is one of three plans that will be used to complete HWMA/RCRA closure of the ILRW Management System. This partial closure plan will be the first of three phases that will result in closure of the ILRW Management System. The three subsystems that will undergo partial closure are:

1. Phase I: Treatment Subsystem (TAN-616)

2. Phase II: Feed Subsystem (Tanks V-1, -2, -3, and -9)

3. Phase III: Holding Tank Subsystem (PM-2A Tanks).

Final facility closure of the ILRW Management System will be complete when all three identified partial closure phases are complete. This partial closure plan provides for closure of the ILRW Treatment Subsystem. Separate closure plans will be prepared for the ILRW Feed and Holding Tank Subsystems.

Within 60 days of completing the closure activities specified in this partial closure plan, a closure certification of the subsystem will be provided, in accordance with IDAPA 58.01.05.009 (40 CFR 265.115), by an independent PE to the INEEL operating contractor and the U.S. Department of Energy (DOE) Idaho Operations Office. The certification of closure will be submitted as a milestone deliverable under Section 9.8 of the VCO. The PE and owner/operator signatures on the closure certification, which is submitted to the IDEQ, will document the completion of closure activities in accordance with the approved closure plan and State of Idaho HWMA/RCRA requirements. A summary of the validated analytical data and the risk assessment(s) performed in support of closure will be included in the PE certification. The closure certification may also identify any minor changes to the closure plan made without prior approval of the IDEQ. Closure of the ILRW Treatment Subsystem will be considered complete upon receipt of written acceptance issued by the IDEQ. After final closure has been completed the independent PE will document the closure of the entire ILRW Management System and submit the documentation to the IDEQ.

Copies of documentation supporting the closure of each phase of the ILRW Management System will remain in the project files and the INEEL Environmental Affairs Administrative Record in the event that this information is requested by IDEQ. The ILRW Management System is not a hazardous waste disposal facility and, therefore, a “Notice in Deed” and a survey plat are not required.

8. COST AND LIABILITY REQUIREMENTS

The federal government, as owner of the INEEL, is exempt from the requirements to provide cost estimates for closure, to provide a financial assurance mechanism for closure, and regarding state-required mechanism and state assumption of responsibility per IDAPA 58.01.05.009 [40 CFR 265.140(c)]. The federal government, as owner of the INEEL, is also exempt from liability requirements per this same exclusion.

9. REFERENCES

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40 CFR 268, 2003, "Land Disposal Restrictions," *Code of Federal Regulations,* Office of the Federal Register, January 29, 2003.

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Appendix A

Development of Action Levels for the HWMA/RCRA Closure of Ancillary Equipment Associated with the TAN-607 Decontamination Room Sump

Appendix A

Development of Action Levels for the HWMA/RCRA Closure of Ancillary Equipment Associated with the TAN-607 Decontamination Room Sump

The ancillary equipment associated with the TAN-607 decontamination room sump (hereinafter referred to as the decontamination room piping in this appendix) is to be closed under HWMA/RCRA (State of Idaho 1983; 42 USC 6901 et seq.) by decontamination of the internal piping surfaces. Compliance with the performance standard for closure of equipment ancillary to tank systems (40 CFR 265.111 and 265.197) is to be demonstrated for the decontamination room piping by sampling the final rinsate solutions from the decontamination efforts and comparing the resulting analytical data with action levels developed in this appendix. The action levels for the HWMA/RCRA closure of decontamination room piping have been developed to ensure that the piping, subsequent to completion of closure activities, will be left in a state that is protective of human health. This appendix was prepared to present the methodology used to develop action levels specific to this piping. TAN-607 Decontamination Room-specific action levels were developed by defining the acceptable excess cancer risk and HQ thresholds to occupational receptors via soil inhalation and ingestion pathways and calculating corresponding action levels based upon these risk and hazard thresholds. Finally, the excess cancer risk and hazard for all pathways and contaminants at the developed action levels are presented. The technique for calculation of action levels described in this appendix will be applied to any additional COCs identified during the course of closure activities for this ancillary piping.

Step 1: Define the Total Allowable Excess Cancer Risk and Hazard Quotient to the Future Occupational Receptor

The liquid that may come into contact with the closed piping and subsequently contaminate surrounding soil is assumed to exit the piping and enter the surrounding soil at the action level concentration. The surrounding soil is then assumed to be contaminated at equivalent parts per million concentrations. Consequently, risk-based media cleanup standards are appropriate to establish the allowable excess cancer risk and HQ. Protective media cleanup standards for human health means constituent concentrations that result in the total residual risk from a medium to an individual exposed over a lifetime falling within a range from 1E-04 to 1E-06, with a cumulative carcinogenic risk range. For noncarcinogenic effects, EPA generally interprets protective cleanup standards to mean constituent concentration that an individual could be exposed to on a daily basis without appreciable risk of deleterious effect during a lifetime; the hazard index (HI) generally should not exceed 1 (55 Federal Register [FR] 46, 1990; 55 FR 145, 1990; 61 FR 85, 1996). To ensure protectiveness of human health, the most conservative threshold for excess cancer risk, 1.0E−06, will be used for the decontamination room piping. Therefore:

- Total allowable risk threshold = 1.0E-06
- Total allowable HQ threshold = 1.0.

Step 2: Define Receptors and Pathways

The pathways considered for developing decontamination room-specific action levels include:

- Occupational receptor ingestion of contaminated soil
- Occupational receptor inhalation of contaminated soil.

Step 3: Define Contaminants of Concern and Toxicity Parameters

The COC list was developed by defining all HWMA/RCRA-regulated constituents that meet the following criterion: The HWMA/RCRA-regulated constituent was detected during sampling and analysis of the waste historically contained within the TAN-607 decontamination room sump ***and*** the constituent is listed in the EPA Region 9 Preliminary Remediation Goal (PRG) Table (EPA 2003).

Data from historical sampling of the TAN-607 decontamination room sump resulting from sampling events in November 1989, March 1990, January 1991, and May 1991 were reviewed to determine COCs. Any contaminant detected in any of the four specified sampling events was retained for evaluation versus the list of applicable contaminants listed in the EPA Region 9 PRG Table. Applying this criterion allows definition of the complete COC list for HWMA/RCRA closure of the decontamination room piping. The complete list of COCs is provided in Table A-1. As stated in the criterion above, detected constituents that are not listed in the EPA Region 9 PRG Table were excluded from the COC list. Constituents excluded for this reason were 2-methylnaphthalene, acenaphthylene, benzo(g,h,i)perylene, bis(2-ethylhexyl)phthalate, and phenanthrene.

Reference doses (RfDs) and slope factors (SFs) for each of the COCs are provided in Table A-1. This information was obtained from the EPA Region 9 PRG Table (EPA 2003). Toxicity information is available for all COCs listed in Table A-1 with the exception of lead. While there is no specific toxicity information currently available for lead, separate EPA guidance was used to develop the decontamination room-specific action level for lead (see Step 9).

Table A-1. COCs and associated toxicity parameters as provided in the EPA Region 9 PRG Table (EPA 2003).

COC	Oral Slope Factor 1/(mg/Kg-d)	Oral Reference Dose (mg/Kg-d)	Inhalation Slope Factor 1/(mg/Kg-d)	Inhalation Reference Dose (mg/Kg-d)
Barium	-	7.00E-02	-	1.40E-04
Cadmium	-	5.00E-04	6.30E+00	-
Chromium	-	3.00E-03	2.90E+02	2.20E-06
Copper	-	4.00E-02	-	-
Lead	-	-	-	-
Mercury	-	3.00E-04	-	8.60E-05
Nickel	-	2.00E-02	-	-
Silver	-	5.00E-03	-	-
Zinc	-	3.00E-01	-	-
Cyanide (total)	-	2.00E-02	-	8.60E-04
1,1-Dichloroethene	-	5.00E-02	-	5.70E-02
1,2-Dichlorobenzene	-	9.00E-02	-	5.70E-02

Table A-1. (continued).

COC	Oral Slope Factor 1/(mg/Kg-d)	Oral Reference Dose (mg/Kg-d)	Inhalation Slope Factor 1/(mg/Kg-d)	Inhalation Reference Dose (mg/Kg-d)
1,2-Dichloroethene	-	1.00E-02	-	1.00E-02
1,3-Dichlorobenzene	-	9.00E-04	-	9.00E-04
1,4-Dichlorobenzene	2.40E-02	3.00E-02	2.20E-02	3.00E-02
2-Butanone	-	6.00E-01	-	2.90E-01
Dichlrorodifluoromethane	-	2.00E-01	-	5.70E-02
Ethylbenzene	3.85E-03	1.00E-01	3.85E-03	2.90E-01
Methylene Chloride	7.50E-03	6.00E-02	1.60E-03	8.60E-01
Tetrachloroethene	5.20E-02	1.00E-02	1.00E-02	1.70E-01
Toluene	-	2.00E-01	-	1.10E-01
Trichloroethene	4.00E-01	3.00E-04	4.00E-01	1.00E-02
1,2,4-Trichlorobenzene	-	1.00E-02	-	5.70E-02
Acenaphthene	-	6.00E-02	-	6.00E-02
Benzo(a)anthracene	7.30E-01	-	7.30E-01	-
Benzo(a)pyrene	7.30E+00	-	7.30E+00	-
Benzo(b)fluoranthene	7.30E-01	-	7.30E-01	-
Butylbenzylphthalate	-	2.00E-01	-	2.00E-01
Chrysene	7.30E-03	-	7.30E-03	-
Diethylphthalate	-	8.00E-01	-	8.00E-01
Di(n)octylphthalate	-	4.00E-02	-	4.00E-02
Fluoranthene	-	4.00E-02	-	4.00E-02
Fluorene	-	4.00E-02	-	4.00E-02
Naphthalene	-	2.00E-02	-	8.60E-04
Phenol	-	6.00E-01	-	6.00E-01
Pyrene	-	3.00E-02	-	3.00E-02

Step 4: Define Percentage of Risk and Hazard to be Applied to Ingestion and Inhalation Scenario

The total allowable excess cancer risk and HQ must be split into the fraction that is allowable for the ingestion pathway and the fraction that is allowable for the inhalation pathway. Experience indicates that the ingestion pathway will drive the risk and hazard for the occupational receptor. Consequently, the majority (99.5%) of the allowable risk and hazard defined in Step 1 above was assigned to the ingestion pathway as shown in Table A-2.

Table A-2. Pathway-specific allowable risk and hazard.

	Total	Ingestion Percentage	Inhalation Percentage	Ingestion Fraction	Inhalation Fraction
Risk	1.00E-06	9.95E-01	5.00E-03	9.95E-07	5.00E-09
Hazard Quotient	1.00	9.95E-01	5.00E-03	9.95E-01	5.00E-03

Step 5: Calculate the COC-Specific Allowable Risk and Hazard Quotient for Each Pathway

Back calculation of decontamination room-specific action levels for COCs requires determination of allowable risk for each COC.[c] The sum of all allowable risks must be less than 1.0E-06. To determine the allowable risk for each COC, the total allowable risk must be apportioned among the COCs. There are several techniques for apportioning allowable risk among COCs.

The simplest technique for apportioning allowable risk is to distribute allowable risk equally among the COCs. Using this technique, the allowable risk is divided by the total number of carcinogenic COCs and the result is used as the allowable risk for each COC. The problem with this approach is that it makes no differentiation among COCs with respect to carcinogenic threat to human health. In the case of the action level determination for the HWMA/RCRA closure of the decontamination room piping, the same allowable risk is assigned to a COC that is extremely carcinogenic (benzo(a)pyrene [slope factor 7.3 $(mg/kg\text{-}d)^{-1}$]) and a contaminant that is minimally carcinogenic (methylene chloride [slope factor 0.0075 $(mg/kg\text{-}d)^{-1}$]). Using this approach results in decontamination room-specific action levels that are extremely low (below detection levels in many instances) for the highly carcinogenic compounds and action levels that are excessively high for minimally carcinogenic compounds. This approach results in decontamination efforts being driven by the need to meet a single action level for the most carcinogenic component. The actual COC concentrations for the less carcinogenic components will be reduced far below decontamination room-specific action levels, resulting in a total residual risk far below the threshold of 1.0E-06. While extremely conservative, this approach results in action levels that may prove impossible to achieve during closure (particularly those below detection limits).

A second approach uses SF normalization to apportion allowable risk among the COCs. The SFs for all carcinogenic COCs are summed, and the percent SF contribution to the total is used to determine the percent of the allowable risk that is apportioned to each COC. In this way, the majority of the allowable risk is assigned to the COCs that are the most highly carcinogenic. This technique is superior to the equal distribution technique described above because it results in action levels for highly carcinogenic contaminants that are above detection limits and realistically achievable, while still maintaining the overall allowable risk below the regulatory threshold. The problem with this approach for the purposes of determining decontamination room-specific action levels for the closure the equipment under consideration is the presence of the carcinogenic benzo(a)pyrene. This contaminant is extremely carcinogenic with respect to the other COCs present in the tank system. Using the normalization approach, consequently, results in the majority of the allowable risk being assigned to this contaminant. This results in greatly reduced action levels for moderately carcinogenic contaminants such as heavy metals. This approach results in decontamination efforts being driven by the need to meet action levels for the metals. Due to the fact that historical data were used to develop the COC list, and the relative ease of decontaminating organic contaminants versus metals, decontamination to meet the action levels for metals will result in actual concentrations of organic constituents that will be far below the action levels for these constituents. This would result in a total residual risk far below the threshold of 1.0E-06. This approach results in decontamination room-specific action levels for various metals that may prove impossible to achieve during closure.

While both approaches described above result in action levels that are compliant with the need to reduce risk below 1.0E-06, the first approach results in an impracticable action level for the highly

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c. While this discussion of apportioning risk among COCs is written with respect to determination of action levels using carcinogenic contaminants and risk-based back-calculation, it applies equally to determination of action levels using noncarcinogenic contaminants and hazard-based back-calculation.

carcinogenic benzo(a)pyrene. The second approach results in impracticable action levels for a variety of heavy metals. A compromise approach balancing the action levels for benzo(a)pyrene and the metals to achievable, yet protective, levels was developed. This third approach uses logarithmic SF normalization to apportion allowable risk among the COCs. A normalizing power of 0.5 was selected via trial and error that resulted in achievable, yet protective, action levels for all COCs. Each of the SFs was raised to the power of 0.5. These SFs were then summed, and the percent contribution to this sum of each SF was determined. This percent contribution was then used to assign allowable risk to all carcinogenic COCs.

The three approaches above are alternate methods for assigning allowable risk to each COC. The sum of the allowable risk for each approach is the same, at 1.0E-06. Selection of the third technique provides decontamination room-specific action levels that are technically practicable. The true risk resulting from each COC is calculated in Step 7 of this methodology. This true risk is calculated at 3.89E-07, demonstrating that the selected action levels are compliant with the regulatory threshold of 1.0E-06. The calculation of true residual risk is independent of the apportioning of allowable risk performed in this step.

As discussed above, allowable risk and HQs for each COC for each pathway were normalized logarithmically against their expected percent contribution to the overall risk and hazard for each pathway. For carcinogenic risk, the square root of the SF for each COC was determined. The normalized SF percentage was determined by dividing the square root of the SF for each COC by the sum of the square root of the SFs for all COCs for a given pathway. This percent contribution was then multiplied by the total pathway-specific allowable risk to calculate the COC- and pathway-specific allowable risk. To increase the conservativeness of the design, correction factors (discussed below) were applied to COCs, as necessary, to reduce the total allowable risk for each COC. The resulting COC pathway-specific allowable risks for ingestion and inhalation are listed in Table A-3.

For a noncarcinogenic hazard, the square root of the inverse of the RfD for each COC was determined. The normalized inverse RfD percentage was determined by dividing the square root of the inverse reference dose for each COC by the sum of the square root of the inverse reference doses for all COCs for a given pathway. This percent contribution was then multiplied by the total pathway-specific allowable hazard to calculate the COC- and pathway-specific allowable hazard. To increase the conservativeness of the design, correction factors (discussed below) were applied to COCs, as necessary, to reduce the total allowable hazard for each COC. The resulting COC pathway-specific allowable hazard for ingestion and inhalation are listed in Table A-3.

Correction factors were used in the risk calculations to lower the decontamination room-specific action levels of contaminants to meet regulatory thresholds. Risk calculations alone would produce concentrations greater than the maximum concentration of contaminants for the toxicity characteristic. Correction factors, therefore, were used to augment the risk number to ensure hazardous waste is not left in place. Removing hazardous waste is the first criteria for achieving clean closure for the tank system.

Table A-3. COC-specific allowable risk and hazard for the soil ingestion and inhalation pathways.

COC	Effective Allowable Ingestion Risk	Effective Allowable Inhalation Risk	Effective Allowable Ingestion Hazard	Effective Allowable Inhalation Hazard
Barium	-	-	3.31E-04	1.22E-05
Cadmium	-	1.82E-12	4.69E-04	-
Chromium	-	3.40E-10	5.28E-03	3.21E-04
Copper	-	-	1.45E-02	-
Lead	-	-	-	-
Mercury	-	-	1.56E-04	4.81E-07
Nickel	-	-	2.05E-02	-
Silver	-	-	2.35E-04	-
Zinc	-	-	5.28E-03	-
Cyanide (Total)	-	-	4.09E-04	3.25E-06
1,1-Dichloroethene	-	-	3.29E-06	5.06E-09
1,2-Dichlorobenzene	-	-	9.65E-04	1.99E-06
1,2-Dichloroethene	-	-	3.40E-03	5.60E-06
1,3-Dichlorobenzene	-	-	1.61E-02	2.64E-05
1,4-Dichlorobenzene	1.36E-08	1.48E-11	8.35E-03	1.37E-05
2-Butanone	-	-	7.78E-05	1.84E-07
Dichlrorodifluoromethane	-	-	3.59E-04	1.11E-06
Ethylbenzene	6.23E-09	7.09E-12	5.23E-03	5.05E-06
Methylene Chloride	1.22E-08	6.40E-12	9.45E-03	4.11E-06
Tetrachloroethene	3.03E-09	1.51E-12	2.18E-03	8.71E-07
Toluene	-	-	5.88E-04	1.30E-06
Trichloroethene	6.09E-09	6.93E-12	9.15E-03	2.61E-06
1,2,4-Trichlorobenzene	-	-	2.89E-02	1.99E-05
Acenaphthene	-	-	1.18E-02	1.94E-05
Benzo(a)anthracene	8.58E-08	9.76E-11	-	-
Benzo(a)pyrene	1.27E-07	1.44E-10	-	-
Benzo(b)fluoranthene	1.20E-07	1.37E-10	-	-
Butylbenzylphthalate	-	-	6.47E-03	1.06E-05
Chrysene	1.50E-08	1.71E-11	-	-
Diethylphthalate	-	-	3.24E-03	5.32E-06
Di(n)octylphthalate	-	-	1.45E-02	2.38E-05
Fluoranthene	-	-	1.45E-02	2.38E-05
Fluorene	-	-	1.45E-02	2.38E-05
Naphthalene	-	-	2.15E-03	1.71E-05
Phenol	-	-	3.74E-03	6.15E-06
Pyrene	-	-	1.67E-02	2.75E-05
Total	3.89E-07	7.74E-10	2.19E-01	5.77E-04

In an effort to develop decontamination room-specific action levels at appropriate concentrations and meet project goals for protection of the public and the environment, correction factors were developed on a case-by-case basis and may vary for different tank systems. Systems that are fairly accessible and with contamination that can be removed to low concentrations will have different correction factors than those used for tank systems that are not easily accessible and where effective decontamination may be more difficult to achieve. Two important points should be recognized:

1. Correction factors are not intended to be the same for all closure actions. Therefore, the DOE can develop action levels as conservative as possible on a project basis.

2. Action levels will always be protective of human health and the environment based on the calculated risks and HI.

The use of correction factors is performed to lower decontamination room-specific action levels to concentrations below regulatory thresholds while accounting for project-specific challenges to clean closure. The correction factors are not used to adjust for the uncertainty of any closure project. The difference between the use of correction factors and accounting for uncertainty is clearly established by the following explanation.

Using conservative assumptions when calculating the risk and HQ negates uncertainties associated with meeting the performance standard for clean closure. For example, risk and hazard indices are based on the total number of constituents that may be detected in the unit. Actually, some of these constituents (particularly organic compounds) will not be present after waste removal and decontamination. For example, benzo(a)pyrene is a significant contributor to risk. However, it is likely that this compound will not be detected during final sampling. The total risk will then be reduced by the amount contributed by benzo(a)pyrene. The calculated risk for benzo(a)pyrene from soil ingestion and inhalation is 1.27E-07. This is the greatest risk contributor in the decontamination room piping.

Step 6: Calculate the COC- and Pathway-Specific Action Levels from Allowable Risk and Hazard Calculated in Step 5

The equations used to relate risk, intake factor, and SF or RfD to excess cancer risk or HQ are given in Step 7. These equations were obtained from EPA guidance (EPA 1989). The risk-based COC-specific action levels were calculated from COC-specific allowable risk by dividing the COC-specific allowable risk (Table A-3) by the intake factor coefficient (see Step 7) and the COC-specific SF (Table A-1). The hazard-based COC-specific action levels were calculated from COC-specific allowable HQs by dividing the COC-specific allowable HQ (Table A-3) by the intake factor coefficient (see Step 7) and multiplying by the RfD (Table A-1). The COC-specific action levels for the ingestion and inhalation pathways resulting from COC-specific allowable risk and COC-specific allowable hazard are listed in Table A-4. To be conservative, the minimum pathway-specific action level was used as the overall action level. The final effective decontamination room-specific action levels are provided in the right-hand column of Table A-4.

Table A-4. Pathway-specific and effective decontamination room-specific action levels for each COC.

COC	Action Level (mg/Kg) Ingestion Risk	Action Level (mg/Kg) Inhalation Risk	Action Level (mg/Kg) Ingestion Hazard	Action Level (mg/Kg) Inhalation Hazard	Effective Action Level (mg/Kg)
Barium	-	-	5.93E+01	1.52E+03	5.93E+01
Cadmium	-	7.21E-01	5.99E-01	-	5.99E-01
Chromium	-	2.93E+00	4.05E+01	6.30E+02	2.93E+00
Copper	-	-	1.48E+03	-	1.48E+03
Lead	-	-	-	-	0.00E+00 [a]
Mercury	-	-	1.20E-01	3.69E+01	1.20E-01
Nickel	-	-	1.05E+03	-	1.05E+03
Silver	-	-	3.00E+00	-	3.00E+00
Zinc	-	-	4.05E+03	-	4.05E+03
Cyanide (Total)	-	-	2.09E+01	2.49E+03	2.09E+01
1,1-Dichloroethene	-	-	4.20E-01	2.58E+02	4.20E-01
1,2-Dichlorobenzene	-	-	2.22E+02	1.01E+05	2.22E+02
1,2-Dichloroethene	-	-	8.70E+01	5.00E+04	8.70E+01
1,3-Dichlorobenzene	-	-	3.70E+01	2.12E+04	3.70E+01
1,4-Dichlorobenzene	4.06E+00	1.68E+03	6.40E+02	3.68E+05	4.06E+00
2-Butanone	-	-	1.19E+02	4.77E+04	1.19E+02
Dichlrorodifluoromethane	-	-	1.84E+02	5.64E+04	1.84E+02
Ethylbenzene	1.16E+01	4.60E+03	1.34E+03	1.31E+06	1.16E+01
Methylene Chloride	1.16E+01	9.99E+03	1.45E+03	3.15E+06	1.16E+01
Tetrachloroethene	4.16E-01	3.77E+02	5.58E+01	1.32E+05	4.16E-01
Toluene	-	-	3.01E+02	1.28E+05	3.01E+02
Trichloroethene	1.09E-01	4.33E+01	7.02E+00	2.33E+04	1.09E-01
1,2,4-Trichlorobenzene	-	-	7.39E+02	1.01E+06	7.39E+02
Acenaphthene	-	-	1.81E+03	1.04E+06	1.81E+03
Benzo(a)anthracene	8.41E-01	3.34E+02	-	-	8.41E-01
Benzo(a)pyrene	1.24E-01	4.93E+01	-	-	1.24E-01
Benzo(b)fluoranthene	1.18E+00	4.68E+02	-	-	1.18E+00
Butylbenzylphthalate	-	-	3.31E+03	1.90E+06	3.31E+03
Chrysene	1.47E+01	5.85E+03	-	-	1.47E+01
Diethylphthalate	-	-	6.61E+03	3.80E+06	6.61E+03
Di(n)octylphthalate	-	-	1.48E+03	8.50E+05	1.48E+03
Fluoranthene	-	-	1.48E+03	8.50E+05	1.48E+03
Fluorene	-	-	1.48E+03	8.50E+05	1.48E+03
Naphthalene	-	-	1.10E+02	1.31E+04	1.10E+02
Phenol	-	-	5.73E+03	3.29E+06	5.73E+03
Pyrene	-	-	1.28E+03	7.36E+05	1.28E+03

a. The decontamination room-specific action level for lead cannot be determined using a risk-based approach, as there are currently no established toxicity parameters for lead. The action level for lead was developed as described in Step 9.

Step 7: Determine the True Excess Cancer Risk and Hazard Quotient Resulting in the Decontamination Room-Specific Action Levels Calculated in Step 6

Soil concentrations resulting from the calculated decontamination room-specific action levels were used as a starting point to assess the risk and hazard to the occupational receptor via the soil ingestion and inhalation pathways. The results of this analysis are provided in Table A-5. The table also includes the cumulative risk and hazard posed by both pathways. The calculation spreadsheets are shown on the following pages in Equations (A-1) through (A-9) and Tables A-6 through A-9.

Table A-5. Cumulative excess cancer risk and HQ resulting from soil ingestion and soil inhalation pathways to an occupational receptor from contaminated soil at the effective decontamination room-specific action levels presented in Table A-4.

COC	Risk (Ingestion Pathway)	Risk (Inhalation Pathway)	Total Risk	Hazard Quotient (Ingestion Pathway)	Hazard Quotient (Inhalation Pathway)	Total Hazard Quotient
Barium	-	-	-	3.31E-04	4.74E-07	3.32E-04
Cadmium	-	1.51E-12	1.51E-12	4.69E-04	-	4.69E-04
Chromium	-	3.40E-10	3.40E-10	3.83E-04	1.49E-06	3.84E-04
Copper	-	-	-	1.45E-02	-	1.45E-02
Lead	-	-	-	-	-	-
Mercury	-	-	-	1.56E-04	1.56E-09	1.56E-04
Nickel	-	-	-	2.05E-02	-	2.05E-02
Silver	-	-	-	2.35E-04	-	2.35E-04
Zinc	-	-	-	5.28E-03	-	5.28E-03
Cyanide (Total)	-	-	-	4.09E-04	2.72E-08	4.09E-04
1,1-Dichloroethene	-	-	-	3.29E-06	8.25E-12	3.29E-06
1,2-Dichlorobenzene	-	-	-	9.65E-04	4.36E-09	9.65E-04
1,2-Dichloroethene	-	-	-	3.40E-03	9.74E-09	3.40E-03
1,3-Dichlorobenzene	-	-	-	1.61E-02	4.60E-08	1.61E-02
1,4-Dichlorobenzene	1.36E-08	3.57E-14	1.36E-08	5.30E-05	1.52E-10	5.30E-05
2-Butanone	-	-	-	7.78E-05	4.61E-10	7.78E-05
Dichlrorodifluoromethane	-	-	-	3.59E-04	3.61E-09	3.59E-04
Ethylbenzene	6.23E-09	1.78E-14	6.23E-09	4.53E-05	4.47E-11	4.53E-05
Methylene Chloride	1.22E-08	7.44E-15	1.22E-08	7.58E-05	1.51E-11	7.58E-05
Tetrachloroethene	3.03E-09	1.67E-15	3.03E-09	1.63E-05	2.74E-12	1.63E-05
Toluene	-	-	-	5.88E-04	3.06E-09	5.88E-04
Trichloroethene	6.09E-09	1.74E-14	6.09E-09	1.42E-04	1.22E-11	1.42E-04
1,2,4-Trichlorobenzene	-	-	-	2.89E-02	1.45E-08	2.89E-02
Acenaphthene	-	-	-	1.18E-02	3.38E-08	1.18E-02
Benzo(a)anthracene	8.58E-08	2.46E-13	8.58E-08	-	-	-
Benzo(a)pyrene	1.27E-07	3.62E-13	1.27E-07	-	-	-
Benzo(b)fluoranthene	1.20E-07	3.44E-13	1.20E-07	-	-	-
Butylbenzylphthalate	-	-	-	6.47E-03	1.85E-08	6.47E-03
Chrysene	1.50E-08	4.30E-14	1.50E-08	-	-	-
Diethylphthalate	-	-	-	3.24E-03	9.26E-09	3.24E-03
Di(n)octylphthalate	-	-	-	1.45E-02	4.14E-08	1.45E-02
Fluoranthene	-	-	-	1.45E-02	4.14E-08	1.45E-02
Fluorene	-	-	-	1.45E-02	4.14E-08	1.45E-02
Naphthalene	-	-	-	2.15E-03	1.43E-07	2.15E-03
Phenol	-	-	-	3.74E-03	1.07E-08	3.74E-03
Pyrene	-	-	-	1.67E-02	4.78E-08	1.67E-02
Total	3.89E-07	3.43E-10	3.89E-07	1.80E-01	2.47E-06	1.80E-01

Occupational Soil Ingestion

$$Intake\ Factor = \left(\frac{C \times FI \times EF \times CF}{AT}\right) \times \left(\frac{IR \times ED}{BW}\right) \tag{A-1}$$

where

C	=	contaminant concentration (mg/kg) (contaminant dependent)
FI	=	fraction ingested from source = 1
EF	=	exposure frequency (day/year) = 200
CF	=	conversion factor (kg/mg) = 1.00E-06
AT	=	averaging time (day) = 2.555E+04
IR	=	ingestion rate (mg/day) = 50
ED	=	exposure duration (year) = 25
BW	=	body weight (kg) = 70.

Assumption: Each liter of leachate contaminates 1 kg of soil.

$$\text{Risk} = \text{Intake Factor} \times \text{Slope Factor} \tag{A-2}$$

Table A-6. Calculation of excess cancer risk for an occupational soil ingestion scenario using the decontamination room-specific action levels provided in Table A-4.

Constituent	C (mg/Kg)	Intake Factor/C (1/day)	Intake Factor (mg/Kg-day)	Slope Factor (Kg-day/mg)	Risk	Risk Percentage
Barium	5.93E+01	1.40E-07	8.29E-06	0.00E+00	-	-
Cadmium	5.99E-01	1.40E-07	8.37E-08	0.00E+00	-	-
Chromium	2.93E+00	1.40E-07	4.10E-07	0.00E+00	-	-
Copper	1.48E+03	1.40E-07	2.07E-04	0.00E+00	-	-
Lead	0.00E+00	1.40E-07	0.00E+00	0.00E+00	-	-
Mercury	1.20E-01	1.40E-07	1.68E-08	0.00E+00	-	-
Nickel	1.05E+03	1.40E-07	1.46E-04	0.00E+00	-	-
Silver	3.00E+00	1.40E-07	4.19E-07	0.00E+00	-	-
Zinc	4.05E+03	1.40E-07	5.66E-04	0.00E+00	-	-
Cyanide (Total)	2.09E+01	1.40E-07	2.92E-06	0.00E+00	-	-
1,1-Dichloroethene	4.20E-01	1.40E-07	5.87E-08	0.00E+00	-	-
1,2-Dichlorobenzene	2.22E+02	1.40E-07	3.10E-05	0.00E+00	-	-
1,2-Dichloroethene	8.70E+01	1.40E-07	1.22E-05	0.00E+00	-	-
1,3-Dichlorobenzene	3.70E+01	1.40E-07	5.17E-06	0.00E+00	-	-
1,4-Dichlorobenzene	4.06E+00	1.40E-07	5.67E-07	2.40E-02	1.36E-08	3.50%
2-Butanone	1.19E+02	1.40E-07	1.67E-05	0.00E+00	-	-
Dichlrorodifluoromethane	1.84E+02	1.40E-07	2.57E-05	0.00E+00	-	-
Ethylbenzene	1.16E+01	1.40E-07	1.62E-06	3.85E-03	6.23E-09	1.60%
Methylene Chloride	1.16E+01	1.40E-07	1.62E-06	7.50E-03	1.22E-08	3.13%
Tetrachloroethene	4.16E-01	1.40E-07	5.82E-08	5.20E-02	3.03E-09	0.78%
Toluene	3.01E+02	1.40E-07	4.20E-05	0.00E+00	-	-
Trichloroethene	1.09E-01	1.40E-07	1.52E-08	4.00E-01	6.09E-09	1.57%
1,2,4-Trichlorobenzene	7.39E+02	1.40E-07	1.03E-04	0.00E+00	-	-
Acenaphthene	1.81E+03	1.40E-07	2.53E-04	0.00E+00	-	-
Benzo(a)anthracene	8.41E-01	1.40E-07	1.18E-07	7.30E-01	8.58E-08	22.07%
Benzo(a)pyrene	1.24E-01	1.40E-07	1.74E-08	7.30E+00	1.27E-07	32.58%
Benzo(b)fluoranthene	1.18E+00	1.40E-07	1.65E-07	7.30E-01	1.20E-07	30.90%
Butylbenzylphthalate	3.31E+03	1.40E-07	4.62E-04	0.00E+00	-	-
Chrysene	1.47E+01	1.40E-07	2.06E-06	7.30E-03	1.50E-08	3.86%
Diethylphthalate	6.61E+03	1.40E-07	9.24E-04	0.00E+00	-	-
Di(n)octylphthalate	1.48E+03	1.40E-07	2.07E-04	0.00E+00	-	-
Fluoranthene	1.48E+03	1.40E-07	2.07E-04	0.00E+00	-	-
Fluorene	1.48E+03	1.40E-07	2.07E-04	0.00E+00	-	-
Naphthalene	1.10E+02	1.40E-07	1.54E-05	0.00E+00	-	-
Phenol	5.73E+03	1.40E-07	8.01E-04	0.00E+00	-	-
Pyrene	1.28E+03	1.40E-07	1.79E-04	0.00E+00	-	-
Total					3.89E-07	100.00%

Occupational Soil Inhalation

$$Intake\ Factor = \left(\frac{C \times IR \times EF \times ET \times ED}{BW \times AT \times PEF}\right) \tag{A-3}$$

where

C	=	soil contaminant concentration (mg/kg) (contaminant dependent)
IR	=	inhalation rate (m^3/hr) = 0.83
EF	=	exposure frequency (day/year) = 200
ET	=	exposure time (hour/day) = 10
ED	=	exposure duration (year) = 25
BW	=	body weight (kg) = 70
AT	=	averaging time (day) = 2.555E+04
PEF	=	particulate emission factor (m^3/kg) (calculated).

$$PEF = \frac{LS \times 5.8\text{E}+10}{A}\left(\frac{m^4}{kg}\right) \tag{A-4}$$

where

LS	=	prevailing wind field dimension (m) = 350
A	=	area of contamination (m^2) = 350.

Assumption: Each liter of leachate contaminates 1 kg of soil.

$$Risk = Intake\ Factor \times Slope\ Factor \tag{A-5}$$

Table A-7. Calculation of excess cancer risk for an occupational soil inhalation scenario using the decontamination room-specific action levels provided in Table A-4.

Constituent	C (mg/Kg)	Intake Factor/C (1/day)	Intake Factor (mg/Kg-day)	Slope Factor (Kg-day/mg)	Risk	Risk Percentage
Barium	5.93E+01	4.00E-13	2.37E-11	0.00E+00	-	-
Cadmium	5.99E-01	4.00E-13	2.40E-13	6.30E+00	1.51E-12	0.44%
Chromium	2.93E+00	4.00E-13	1.17E-12	2.90E+02	3.40E-10	99.25%
Copper	1.48E+03	4.00E-13	5.92E-10	0.00E+00	-	-
Lead	0.00E+00	4.00E-13	0.00E+00	0.00E+00	-	-
Mercury	1.20E-01	4.00E-13	4.80E-14	0.00E+00	-	-
Nickel	1.05E+03	4.00E-13	4.18E-10	0.00E+00	-	-
Silver	3.00E+00	4.00E-13	1.20E-12	0.00E+00	-	-
Zinc	4.05E+03	4.00E-13	1.62E-09	0.00E+00	-	-
Cyanide (Total)	2.09E+01	4.00E-13	8.37E-12	0.00E+00	-	-
1,1-Dichloroethene	4.20E-01	4.00E-13	1.68E-13	0.00E+00	-	-
1,2-Dichlorobenzene	2.22E+02	4.00E-13	8.87E-11	0.00E+00	-	-
1,2-Dichloroethene	8.70E+01	4.00E-13	3.48E-11	0.00E+00	-	-
1,3-Dichlorobenzene	3.70E+01	4.00E-13	1.48E-11	0.00E+00	-	-
1,4-Dichlorobenzene	4.06E+00	4.00E-13	1.62E-12	2.20E-02	3.57E-14	0.01%
2-Butanone	1.19E+02	4.00E-13	4.77E-11	0.00E+00	-	-
Dichlrorodifluoromethane	1.84E+02	4.00E-13	7.35E-11	0.00E+00	-	-
Ethylbenzene	1.16E+01	4.00E-13	4.63E-12	3.85E-03	1.78E-14	0.01%
Methylene Chloride	1.16E+01	4.00E-13	4.65E-12	1.60E-03	7.44E-15	0.00%
Tetrachloroethene	4.16E-01	4.00E-13	1.67E-13	1.00E-02	1.67E-15	0.00%
Toluene	3.01E+02	4.00E-13	1.20E-10	0.00E+00	-	-
Trichloroethene	1.09E-01	4.00E-13	4.36E-14	4.00E-01	1.74E-14	0.01%
1,2,4-Trichlorobenzene	7.39E+02	4.00E-13	2.96E-10	0.00E+00	-	-
Acenaphthene	1.81E+03	4.00E-13	7.25E-10	0.00E+00	-	-
Benzo(a)anthracene	8.41E-01	4.00E-13	3.36E-13	7.30E-01	2.46E-13	0.07%
Benzo(a)pyrene	1.24E-01	4.00E-13	4.97E-14	7.30E+00	3.62E-13	0.11%
Benzo(b)fluoranthene	1.18E+00	4.00E-13	4.71E-13	7.30E-01	3.44E-13	0.10%
Butylbenzylphthalate	3.31E+03	4.00E-13	1.32E-09	0.00E+00	-	-
Chrysene	1.47E+01	4.00E-13	5.89E-12	7.30E-03	4.30E-14	0.01%
Diethylphthalate	6.61E+03	4.00E-13	2.65E-09	0.00E+00	-	-
Di(n)octylphthalate	1.48E+03	4.00E-13	5.92E-10	0.00E+00	-	-
Fluoranthene	1.48E+03	4.00E-13	5.92E-10	0.00E+00	-	-
Fluorene	1.48E+03	4.00E-13	5.92E-10	0.00E+00	-	-
Naphthalene	1.10E+02	4.00E-13	4.40E-11	0.00E+00	-	-
Phenol	5.73E+03	4.00E-13	2.29E-09	0.00E+00	-	-
Pyrene	1.28E+03	4.00E-13	5.12E-10	0.00E+00	-	-
Total					3.43E-10	100.00%

Occupational Soil Ingestion

$$Intake\ Factor = \left(\frac{C \times FI \times EF \times CF}{AT}\right) \times \left(\frac{IR \times ED}{BW}\right) \qquad \text{(A-6)}$$

where

C	=	contaminant concentration (mg/kg) (contaminant dependent)
FI	=	fraction ingested from source = 1
EF	=	exposure frequency (day/year) = 200
CF	=	conversion factor (kg/mg) = 1.00E-06
AT	=	averaging time (day) = 9.125E+03
IR	=	ingestion rate (mg/day) = 50
ED	=	exposure duration (year) = 25
BW	=	body weight (kg) = 70.

Assumption: Each liter of leachate contaminates 1 kg of soil.

$$Hazard = Intake\ Factor/Reference\ Dose \qquad \text{(A-7)}$$

Table A-8. Calculation of hazard quotient for an occupational soil ingestion scenario using the decontamination room-specific action levels provided in Table A-4.

Constituent	C (mg/Kg)	Intake Factor/C (1/day)	Intake Factor (mg/Kg/day)	Reference Dose (mg/Kg/day)	Hazard Quotient	Hazard Quotient Percentage
Barium	5.93E+01	3.91E-07	2.32E-05	7.00E-02	3.31E-04	0.18%
Cadmium	5.99E-01	3.91E-07	2.34E-07	5.00E-04	4.69E-04	0.26%
Chromium	2.93E+00	3.91E-07	1.15E-06	3.00E-03	3.83E-04	0.21%
Copper	1.48E+03	3.91E-07	5.79E-04	4.00E-02	1.45E-02	8.02%
Lead	0.00E+00	3.91E-07	0.00E+00	0.00E+00	-	-
Mercury	1.20E-01	3.91E-07	4.69E-08	3.00E-04	1.56E-04	0.09%
Nickel	1.05E+03	3.91E-07	4.09E-04	2.00E-02	2.05E-02	11.34%
Silver	3.00E+00	3.91E-07	1.17E-06	5.00E-03	2.35E-04	0.13%
Zinc	4.05E+03	3.91E-07	1.59E-03	3.00E-01	5.28E-03	2.93%
Cyanide (Total)	2.09E+01	3.91E-07	8.19E-06	2.00E-02	4.09E-04	0.23%
1,1-Dichloroethene	4.20E-01	3.91E-07	1.64E-07	5.00E-02	3.29E-06	0.00%
1,2-Dichlorobenzene	2.22E+02	3.91E-07	8.68E-05	9.00E-02	9.65E-04	0.53%
1,2-Dichloroethene	8.70E+01	3.91E-07	3.40E-05	1.00E-02	3.40E-03	1.89%
1,3-Dichlorobenzene	3.70E+01	3.91E-07	1.45E-05	9.00E-04	1.61E-02	8.91%
1,4-Dichlorobenzene	4.06E+00	3.91E-07	1.59E-06	3.00E-02	5.30E-05	0.03%
2-Butanone	1.19E+02	3.91E-07	4.67E-05	6.00E-01	7.78E-05	0.04%
Dichlrorodifluoromethane	1.84E+02	3.91E-07	7.19E-05	2.00E-01	3.59E-04	0.20%
Ethylbenzene	1.16E+01	3.91E-07	4.53E-06	1.00E-01	4.53E-05	0.03%
Methylene Chloride	1.16E+01	3.91E-07	4.55E-06	6.00E-02	7.58E-05	0.04%
Tetrachloroethene	4.16E-01	3.91E-07	1.63E-07	1.00E-02	1.63E-05	0.01%
Toluene	3.01E+02	3.91E-07	1.18E-04	2.00E-01	5.88E-04	0.33%
Trichloroethene	1.09E-01	3.91E-07	4.26E-08	3.00E-04	1.42E-04	0.08%
1,2,4-Trichlorobenzene	7.39E+02	3.91E-07	2.89E-04	1.00E-02	2.89E-02	16.04%
Acenaphthene	1.81E+03	3.91E-07	7.09E-04	6.00E-02	1.18E-02	6.55%
Benzo(a)anthracene	8.41E-01	3.91E-07	3.29E-07	0.00E+00	-	-
Benzo(a)pyrene	1.24E-01	3.91E-07	4.86E-08	0.00E+00	-	-
Benzo(b)fluoranthene	1.18E+00	3.91E-07	4.61E-07	0.00E+00	-	-
Butylbenzylphthalate	3.31E+03	3.91E-07	1.29E-03	2.00E-01	6.47E-03	3.59%
Chrysene	1.47E+01	3.91E-07	5.76E-06	0.00E+00	-	-
Diethylphthalate	6.61E+03	3.91E-07	2.59E-03	8.00E-01	3.24E-03	1.79%
Di(n)octylphthalate	1.48E+03	3.91E-07	5.79E-04	4.00E-02	1.45E-02	8.02%
Fluoranthene	1.48E+03	3.91E-07	5.79E-04	4.00E-02	1.45E-02	8.02%
Fluorene	1.48E+03	3.91E-07	5.79E-04	4.00E-02	1.45E-02	8.02%
Naphthalene	1.10E+02	3.91E-07	4.31E-05	2.00E-02	2.15E-03	1.19%
Phenol	5.73E+03	3.91E-07	2.24E-03	6.00E-01	3.74E-03	2.07%
Pyrene	1.28E+03	3.91E-07	5.01E-04	3.00E-02	1.67E-02	9.26%
Total					1.80E-01	100.00%

Occupational Soil Inhalation

$$Intake\ Factor = \left(\frac{C \times IR \times EF \times ET \times ED}{BW \times AT \times PEF} \right) \tag{A-8}$$

where

C	=	soil contaminant concentration (mg/kg) (contaminant dependent)
IR	=	inhalation rate (m^3/hr) = 0.83
EF	=	exposure frequency (day/year) = 200
ET	=	exposure time (hour/day) = 10
ED	=	exposure duration (year) = 25
BW	=	body weight (kg) = 70
AT	=	averaging time (day) = 9.125E+03
PEF	=	particulate emission factor (m^3/kg) (calculated).

$$PEF = \frac{LS \times 5.8\text{E}+10}{A} \left(\frac{m^4}{kg} \right)$$

where

LS	=	prevailing wind field dimension (m) = 350
A	=	area of contamination (m^2) = 350.

Assumption: Each liter of leachate contaminates 1 kg of soil.

$$Hazard = Intake\ Factor/Reference\ Dose \tag{A-9}$$

Table A-9. Calculation of hazard quotient for an occupational soil inhalation scenario using the decontamination room-specific action levels provided in Table A-4.

Constituent	C (mg/Kg)	Intake Factor/C (1/day)	Intake Factor (mg/Kg-day)	Reference Dose (mg/Kg/day)	Hazard Quotient	Hazard Quotient Percentage
Barium	5.93E+01	1.12E-12	6.64E-11	1.40E-04	4.74E-07	19.23%
Cadmium	5.99E-01	1.12E-12	6.71E-13	0.00E+00	-	-
Chromium	2.93E+00	1.12E-12	3.29E-12	2.20E-06	1.49E-06	60.56%
Copper	1.48E+03	1.12E-12	1.66E-09	0.00E+00	-	-
Lead	0.00E+00	1.12E-12	0.00E+00	0.00E+00	-	-
Mercury	1.20E-01	1.12E-12	1.34E-13	8.60E-05	1.56E-09	0.06%
Nickel	1.05E+03	1.12E-12	1.17E-09	0.00E+00	-	-
Silver	3.00E+00	1.12E-12	3.36E-12	0.00E+00	-	-
Zinc	4.05E+03	1.12E-12	4.54E-09	0.00E+00	-	-
Cyanide (Total)	2.09E+01	1.12E-12	2.34E-11	8.60E-04	2.72E-08	1.10%
1,1-Dichloroethene	4.20E-01	1.12E-12	4.70E-13	5.70E-02	8.25E-12	0.00%
1,2-Dichlorobenzene	2.22E+02	1.12E-12	2.48E-10	5.70E-02	4.36E-09	0.18%
1,2-Dichloroethene	8.70E+01	1.12E-12	9.74E-11	1.00E-02	9.74E-09	0.40%
1,3-Dichlorobenzene	3.70E+01	1.12E-12	4.14E-11	9.00E-04	4.60E-08	1.87%
1,4-Dichlorobenzene	4.06E+00	1.12E-12	4.55E-12	3.00E-02	1.52E-10	0.01%
2-Butanone	1.19E+02	1.12E-12	1.34E-10	2.90E-01	4.61E-10	0.02%
Dichlrorodifluoromethane	1.84E+02	1.12E-12	2.06E-10	5.70E-02	3.61E-09	0.15%
Ethylbenzene	1.16E+01	1.12E-12	1.30E-11	2.90E-01	4.47E-11	0.00%
Methylene Chloride	1.16E+01	1.12E-12	1.30E-11	8.60E-01	1.51E-11	0.00%
Tetrachloroethene	4.16E-01	1.12E-12	4.66E-13	1.70E-01	2.74E-12	0.00%
Toluene	3.01E+02	1.12E-12	3.37E-10	1.10E-01	3.06E-09	0.12%
Trichloroethene	1.09E-01	1.12E-12	1.22E-13	1.00E-02	1.22E-11	0.00%
1,2,4-Trichlorobenzene	7.39E+02	1.12E-12	8.28E-10	5.70E-02	1.45E-08	0.59%
Acenaphthene	1.81E+03	1.12E-12	2.03E-09	6.00E-02	3.38E-08	1.37%
Benzo(a)anthracene	8.41E-01	1.12E-12	9.42E-13	0.00E+00	-	-
Benzo(a)pyrene	1.24E-01	1.12E-12	1.39E-13	0.00E+00	-	-
Benzo(b)fluoranthene	1.18E+00	1.12E-12	1.32E-12	0.00E+00	-	-
Butylbenzylphthalate	3.31E+03	1.12E-12	3.70E-09	2.00E-01	1.85E-08	0.75%
Chrysene	1.47E+01	1.12E-12	1.65E-11	0.00E+00	-	-
Diethylphthalate	6.61E+03	1.12E-12	7.41E-09	8.00E-01	9.26E-09	0.38%
Di(n)octylphthalate	1.48E+03	1.12E-12	1.66E-09	4.00E-02	4.14E-08	1.68%
Fluoranthene	1.48E+03	1.12E-12	1.66E-09	4.00E-02	4.14E-08	1.68%
Fluorene	1.48E+03	1.12E-12	1.66E-09	4.00E-02	4.14E-08	1.68%
Naphthalene	1.10E+02	1.12E-12	1.23E-10	8.60E-04	1.43E-07	5.81%
Phenol	5.73E+03	1.12E-12	6.42E-09	6.00E-01	1.07E-08	0.43%
Pyrene	1.28E+03	1.12E-12	1.43E-09	3.00E-02	4.78E-08	1.94%
Total					2.47E-06	100.00%

Step 8: Convert Mass Contaminant Concentration Action Levels in Theoretical Soil to Rinsate Action Levels

The EPA equations for risk assessment use mass concentration of contaminant in soil (e.g., mg/Kg) as an input parameter to estimate risk. In applying these equations to back-calculate action levels, the result is mass contaminant concentration in theoretical soil. For the purpose of estimating the rinsate action levels based upon the calculated action levels, it was assumed that:

1. Liquid infiltration contacts the internal piping surfaces

2. Contacting liquid then exits the piping with all COCs present at action level concentrations

3. Each liter of contaminated liquid contaminates 1 kg of soil (thus, each part per million of contaminant in the liquid is equivalent to one part per million of contaminant in the soil).

Assumption 1 is conservative due to the planned capping of both ends of each line, isolating the line from possible water infiltration. Once the lines and drain assemblies have been capped, it is highly unlikely that water infiltration will contact the internal piping surfaces. Assumption 2 is conservative because it assumes immediate release of liquid contacting the internal piping surfaces from the pipe to the soil. In reality, liquid contacting the internal pipe surfaces will remain contained within the stainless steel piping. Assumption 3 is conservative for three reasons. First, assuming an average bulk soil density of 1.3 kg/L, and an average soil porosity of 0.45, the void volume in a typical kilogram of soil is approximately 350 mL. Thus, although the assumption has been made that each liter of contaminated liquid contaminates 1 kg of soil, in reality, it is only physically possible for 350 mL of the contaminated liquid to contaminate each kilogram of soil. Second, it is assumed that the liquid and soil are in contact for sufficient time to allow mass transfer equilibrium to be reached between the soil column and the liquid, whereas in reality, the water would be flowing through the soil column and equilibrium will not be reached. Finally, it is assumed that 100% of the contaminant is transferred to the soil without regard for partitioning of the contaminant between the soil column and the water. In reality, a fraction of each of the contaminants will remain contained within the contaminated liquid.

Based on the above conservative assumptions, the mass theoretical soil concentrations calculated using this methodology and presented in Figure A-4 have been converted to aqueous rinsate action levels (each part per million of contaminant in the soil is equivalent to one part per million of contaminant in the liquid rinsate) as described in the assumptions specified above. The resultant rinsate action levels are presented in Table 4-2 of the closure plan.

Step 9: Determine a Decontamination Room-Specific Action Level for Lead

Of the COCs currently applicable to the decontamination room piping, only lead does not have a RfD or a SF. The following discussion offers an approach for establishing a decontamination room-specific action level for lead. Soil screening guidance (EPA 2001) suggests a lead soil concentration of 400 mg/kg based on *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities* (EPA 1994). The liquid lead concentration is calculated using the definition of K_d. The K_d value is the ratio of the soil concentration to the liquid concentration. Thus, the action level is calculated by dividing the suggested soil concentration for lead by the K_d. The K_d of lead is 100 cm^3/g (EPA 1996). With these values, the lead action level is calculated at 4 mg/L.

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Appendix B

HWMA/RCRA Closure Risk Assessment Methodology for Environmental Media

Appendix B

HWMA/RCRA Closure Risk Assessment Methodology for Environmental Media

This appendix presents the methodology that will be used to complete a site-specific risk assessment for the purpose of certifying HWMA (State of Idaho 1983)/RCRA (42 USC 6901 et seq.) closure of the ILRW Treatment Subsystem located at TAN, INEEL. Section B-1 provides the regulatory basis for conducting a site-specific risk assessment to demonstrate compliance with the closure performance standards for media associated with tank systems (IDAPA 58.01.05.009 [40 CFR 265.111 and 265.197(a)]. The remaining sections present the conceptual site model used to demonstrate the link between contaminated environmental media and potential receptors, identifies the potentially complete exposure routes that will be evaluated by risk assessment, and summarizes the equations and associated input parameters (both site-specific and, as applicable, EPA default) that will be used to complete the risk assessment. The site-specific risk assessment will be conducted in accordance with EPA guidance (EPA 1989, 2001a).

B-1. REGULATORY BASIS

Since 1987, EPA guidance has interpreted the regulations governing closure of hazardous waste management units as requiring complete removal of all hazardous wastes and liners, and removal or decontamination of leachate, soils, and other materials contaminated with hazardous waste or hazardous constituents to the extent necessary to protect human health and the environment (52 FR 8704, 1987). The EPA further clarified that this interpretation means that, except for hazardous waste and liners, the regulations do not require complete removal of all contamination (e.g., removal to background levels) from a unit being closed to achieve clean closure. Rather, some limited quantity of hazardous constituents might remain in environmental media after clean closure provided that their concentrations are below levels that may pose a risk to human health and the environment. The EPA also took the position that the amount of hazardous constituents that might remain in environmental media after clean closure should be identified through appropriate application of risk information using available constituent-specific limits or factors that have undergone agency review (e.g., maximum contaminant levels or health-based limits calculated using a verified RfD), using toxicity information submitted by a facility owner/operator and approved by the EPA when such limits or factors were not available, or using background comparisons.

The EPA has provided additional guidance on identifying the amount of hazardous constituents that might remain in environmental media after clean closure. The EPA's position is that the procedures and guidance generally used to develop protective, risk-based, media cleanup standards for the RCRA corrective action and CERCLA cleanup programs are also appropriate to define the amount of hazardous constituents that may remain in environmental media after clean closure. In other words, site-specific, risk-based media cleanup levels developed under the RCRA corrective action and CERCLA cleanup programs are appropriate levels at which to define clean closure (55 FR 8666, 1990; 55 FR 30798, 1990; 61 FR 19432, 1996; Cotsworth 1998). In addition, EPA has interpreted current closure regulations to allow appropriate use of nonresidential exposure assumptions when identifying the amount of decontamination necessary to satisfy the "remove or decontaminate" standard (Cotsworth 1998).

B-2. SITE-SPECIFIC RISK THRESHOLD

Protective media cleanup standards for human health are defined as contaminant concentrations that result in the total excess cancer risk to an individual exposed to the medium over a lifetime falling within a range from 1E-04 to 1E-06 (EPA 1990). For noncarcinogenic effects, the EPA generally interprets protective cleanup standards to mean constituent concentrations that an individual could be exposed to on a daily basis without appreciable risk of deleterious effect during a lifetime. For purposes of clean closure certification of the ILRW Treatment Subsystem, the risk presented by the environmental media of concern will be considered acceptable if the total excess cancer risk does not exceed 1E-06 and the HI is less than one.

B-3. EXPOSURE ASSESSMENT

An exposure assessment will be completed to estimate the type, duration, and magnitude of exposure that receptors may experience because of contact with the COCs. A conceptual site model (CSM), which illustrates the contaminant sources, primary release mechanisms, secondary sources and release mechanisms, exposure pathways, exposure routes, and receptors that will be evaluated by the site-specific risk assessment is presented in Figure B-1. The CSM graphically presents the potentially complete exposure routes. Each potentially complete exposure route will be evaluated in detail during the risk assessment using available site-specific parameters and post-closure characterization (sampling of environmental media as part of closure activities) data collected at the conclusion of HWMA/RCRA closure activities.

The exposure assessment has both qualitative and quantitative components. The qualitative component consists primarily of evaluating potentially exposed receptor populations and potential exposure pathways. The quantitative evaluation consists of estimating the exposure point concentrations within the environmental media and quantifying the intake factor associated within each pathway. The qualitative evaluation is presented in the CSM (see Figure B-1) and the quantitative evaluation will be completed using post-closure certification sampling data.

B-3.1 Identification of Potentially Exposed Receptor Populations

As shown in Figure B-1, the only potentially exposed receptor population that will be evaluated is an occupational receptor. The *INEEL Comprehensive Land Use Plan* (DOE-ID 1996) describes the land use of the INEEL, which is currently government-controlled industrial use. The term "controlled" means that unrestricted public access to the INEEL is not available. Access to INEEL facilities requires proper clearance, training, or escort and controls for security reasons and to limit the potential for unacceptable exposures. A security force is used to limit access to approved personnel and visitors. These controls are estimated to be in place until at least 2095. Because the current land use includes continued utilization of operating facilities and access to these facilities is controlled, the only potential receptor is an occupational worker during the current land use scenario.

Future land use scenarios are identified in the *Long-Term Land Use Future Scenarios for the Idaho National Engineering Laboratory* (DOE-ID 1995). This document was developed using a stakeholder process that involved a public participation forum, a public comment period, and the INEEL Citizens Advisory Board. Following review and comment by the public participation forum the document underwent a 30-day public comment period and was subsequently submitted to the Board for review and recommendations. No recommendations for residential use of any portion of the INEEL until at least 2095 have been received to date.

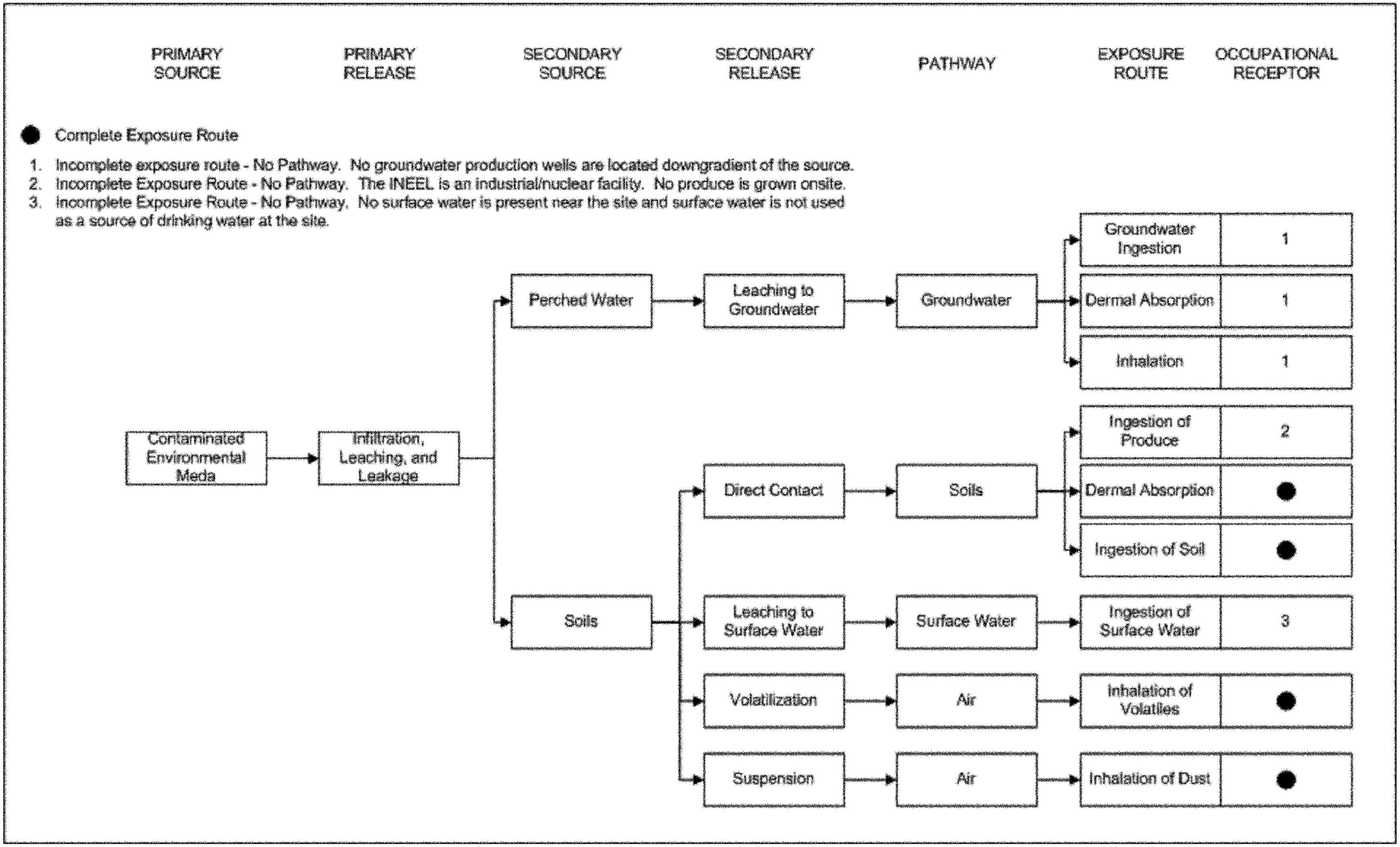

Figure B-1. HWMA/RCRA closure risk assessment conceptual site model.

The INEEL is an industrial nuclear facility that is located in a very rural area with a low population density and projected low growth. Future residential use, especially those areas that are currently or have historically been utilized by INEEL operations, is extremely unlikely. Therefore, for purposes of the site-specific risk assessment, no residential receptors populations will be evaluated.

B-3.2 Identification of Potential Exposure Pathways

The CSM includes various exposure pathways that were determined to be potentially complete and were selected for further evaluation based on the nature of the contamination that may be left in place following HWMA/RCRA closure activities. These pathways are summarized in Table B-1. It should be noted potentially complete exposure pathways are expected to vary between different closure sites due to the variation of site-specific contaminants or the presence of engineering features that prevent exposure from occurring. Each potentially complete exposure pathway will be evaluated and the results documented in the site-specific risk assessment.

Table B-1. Potentially complete exposure pathways to be quantitatively evaluated.

Potentially Exposed Population	Scenario	Potentially Complete Exposure Pathways
Occupational worker	Current and future land use	• Inhalation of volatile organic compounds • Inhalation of airborne particulates • Ingestion of surface soil • Dermal absorption.
Residential	Current land use	Current use of the INEEL is for government-controlled industrial activities (unrestricted public access to the INEEL is not available); there are no potentially complete residential exposure scenarios.
Residential	Future land use	Future land use scenarios are identified in the *Long-Term Land Use Future Scenarios for the Idaho National Engineering Laboratory* (DOE-ID 1995). The document identifies anticipated activities through 2095 and projects that the current industrial uses will continue at the INEEL through at least 2095. Therefore, a future residential exposure scenario is unlikely and is not a complete exposure pathway.

B-3.3 Derivation of Exposure-Point Concentrations

Validated analytical data from post-closure sampling and analysis activities will be used to estimate exposure point concentrations for each COC. Contaminants of concern were established, for purposes of HWMA/RCRA closure, based on process knowledge and historical analytical data from sampling of the tank system being closed or related processes. The risk assessment will account for all contaminants detected, regardless of their inclusion as COCs in the closure plan, during post-closure characterization of the tank system, except as outlined below:

- Data that are rejected per the method validation will be eliminated from the data set used to determine the exposure point concentrations

- Contaminants that are not detected in any samples will be screened from further consideration

- Contaminants for which there are both true detects and non-detects will be retained for evaluation and non-detect data will be assigned an appropriate concentration during DQA using EPA recommended strategies, as presented in *Guidance for Data Quality Assessment: Practical Methods for Data Analysis* (EPA 2000)

- Contaminants for which there is no EPA approved toxicity information (e.g., EPA's Integrated Risk Information System [IRIS] [EPA 2003a] or Region 9 PRG Table [EPA 2003b]) will be screened from further consideration

- Additional screening methodologies may be used in accordance with EPA guidance as necessary and appropriate and will be documented in the site-specific risk assessment.

The screening process is designed to be conservative such that all contaminants that have a reasonable potential for causing adverse human health effects pass the screening and, therefore, will be evaluated in the site-specific risk assessment. Because of the uncertainty associated with any estimate of exposure concentration, the 95% upper confidence level (UCL) is the most appropriate estimate for the COC concentrations (EPA 2001a). Specific calculations for the 95% UCL are dependent upon data distribution (i.e., are the data distributed normally or log normally). For purposes of sampling, it has been assumed that the data will be normally distributed; however, this assumption will be checked and confirmed during the DQA and the appropriate distribution applied to the data to obtain the 95% UCL.

While radiological samples will be collected during closure activities to support waste management activities and future decontamination and dismantlement activities, the risk assessment will not address radionuclides. Residual radioactive contamination is not subject to HWMA/RCRA regulations and will be addressed under a separate regulatory authority.

B-3.3.1 Estimate of Soil Exposure Concentrations

Estimates of soil exposure concentrations will be based directly on the analytical data obtained during closure activities for the environmental media of concern. This assumes that source term concentrations remain constant over time and is conservative.

B-3.3.2 Estimate of Air Exposure Concentrations

Estimates of air exposure concentrations due to emissions will be calculated as average values over the entire area and, therefore, will be the same regardless of location. The air exposure point concentrations will be estimated assuming the release mechanisms are fugitive dust emissions and volatilization. The following sections describe how these concentrations will be estimated.

B-3.3.2.1 Inhalation of Fugitive Dust. A respirable particulate (R) value will be used to estimate the contaminant concentration in the air (C_{AIR}). The R value will be based on the respirable particulate emissions from wind erosion measured at the Idaho Nuclear Technology and Engineering Center (INTEC) (Mitchell 1994), which is assumed to be analogous to TAN. The emissions will be assumed to be steady state with the concentration of the COCs not depleting with time. Equation (B-1) will be used to estimate this value.

$$C_{AIR} = CF \times R \times C_{SOIL} \tag{B-1}$$

where

C_{AIR} = contaminant concentration in the air (mg/m^3)

CF = conversion factor (1E-09 kg/μg)

R = TAN respirable particulate matter (14 μg/m^3) (Mitchell 1994). (This value represents the 95% UCL of the arithmetic mean of weekly airborne particulate matter concentration measured at the INTEC low volume air sampling station, which is assumed to be analogous to TAN.)

C_{SOIL} = contaminant concentration in the soil (mg/kg).

B-3.3.2.2 Inhalation of Volatiles. Appropriate air emission models will be used to predict volatile contaminant exposure concentrations in the air.

B-3.4 Development of Chemical Intakes

Route-specific exposures or intakes will be quantified through the use of standard intake equations, site-specific or default exposure parameters, and exposure point concentrations (as defined in Section B-3.3). Each chemical intake equation (EPA 1989, 2001a) that will be used along with a description of the associated exposure parameters for each scenario is given in Figures B-2 through B-5. In general, site-specific parameters will be used in the intake equations, where available. Where such information is not available, default EPA parameters will be used.

$$\text{Intake (mg/kg} - \text{day)} = C_{soil} \times \left[\frac{(IR \times FI \times EF \times ED) \times CF}{BW \times AT} \right]$$

where

C_{soil} = contaminant concentration in the soil (mg/kg based on 95% UCL)

IR = ingestion rate (50 mg/d)

FI = fraction ingested (1)

EF = exposure frequency (200 d/yr)[d]

ED = exposure duration (25 yr)

CF = conversion factor (10^{-6} kg/mg)

BW = body weight (70 kg)

AT = averaging time (25,550 d for carcinogenic, 9,125 d for noncarcinogenic).

Figure B-2. Soil ingestion chemical intake parameters.[e]

d. Exposure frequency is based on four days per week (at 10 hours per day) for 50 weeks per year.

e. Values shown are default values for the INEEL unless otherwise noted.

$$AD = \frac{C_{soil} \times SA \times AF \times ABS \times EF \times ED \times CF}{BW \times AT}$$

where

AD	=	absorbed dose (mg/kg-d)
C_{soil}	=	contaminant concentration in the soil (mg/kg based on 95% UCL)
SA	=	skin surface area available for contact (3,300 cm^2/event) (EPA 2001b)
AF	=	soil to skin adherence factor (0.2 mg/cm^2) (EPA 2001b)
ABS	=	absorption factor (unitless)
EF	=	exposure frequency (200 events/yr)[f]
ED	=	exposure duration (25 yr)
CF	=	conversion factor (10^{-6} kg/mg)
BW	=	body weight (70 kg)
AT	=	averaging time (25,550 d for carcinogenic, 9,125 d for noncarcinogenic).

Figure B-3. Dermal absorption parameters.[g]

f. Exposure frequency is based on one event per day, four days per week, 50 weeks per year.

g. Values shown are default values for the INEEL unless otherwise noted.

$$\text{Intake (mg/kg - d)} = \frac{C_{air} \times IR \times ET \times EF \times ED \times CF}{BW \times AT}$$

where

C_{air}	=	contaminant concentration in respirable fugitive dust (mg/m^3)
IR	=	inhalation rate (20 m^3/d)
ET	=	exposure time (10 hr/d)
EF	=	exposure frequency (200 d/yr)[h]
ED	=	exposure duration (25 yr)
CF	=	conversion factor (0.04167 d/hr)
BW	=	body weight (70 kg)
AT	=	averaging time (25,550 d for carcinogenic, 9,125 d for noncarcinogenic).

Figure B-4. Inhalation of fugitive dust intake parameters.[i]

h. Exposure frequency is based on four days per week (at 10 hours per day) for 50 weeks per year.

i. Values shown are default values for the INEEL unless otherwise noted.

$$\text{Intake (mg/kg - d)} = \frac{C_{air} \times IR \times ET \times EF \times ED \times CF}{BW \times AT}$$

where

C_{air}	=	volatile contaminant concentration in the air (mg/m^3)
IR	=	inhalation rate (20 m^3/d)
ET	=	exposure time (10 hr/d)
EF	=	exposure frequency (200 d/yr)[j]
ED	=	exposure duration (25 yr)
CF	=	conversion factor (0.04167 d/hr)
BW	=	body weight (70 kg)
AT	=	averaging time (25,550 d for carcinogenic, 9,125 d for noncarcinogenic).

Figure B-5. Inhalation of volatiles intake parameters.[k]

B-4. TOXICITY ASSESSMENT

Toxicity values will be used to characterize risk for the COCs. Consistent with the Risk Assessment Guidance for Superfund (EPA 1989, 2001a), the toxicity information will be summarized for two categories of potential effects: carcinogens and noncarcinogens. The toxicity values that will be used quantitatively in the risk assessment will be obtained from two major sources, IRIS (EPA 2003a) and EPA Region 9 PRG Table (EPA 2003b).

B-4.1 Carcinogens

Potential carcinogenic risks will be expressed as an estimated probability that an individual might develop cancer from a lifetime exposure to a specific concentration of a contaminant. This probability is based on projected intakes and chemical-specific dose-response data called SFs. Slope factors and the estimated daily intake of a compound, averaged over the 24-year exposure duration, will be used to estimate the incremental cancer risk of an occupational worker exposed to that contaminant.

The oral and inhalation SFs for the COCs will be compiled in a table, including the weight-of-evidence (carcinogen groups), source reference, and date. Slope factors will also be provided for the inhalation route as unit risks in units of "microgram per cubic meter" $(\mu g/m^3)^{-1}$.

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j. Exposure frequency is based on four days per week (at 10 hours per day) for 50 weeks per year.

k. Values shown are default values for the INEEL unless otherwise noted.

B-4.2 Noncarcinogens

Potential noncarcinogenic effects will be evaluated in the risk characterization by comparing daily intakes (calculated in the exposure assessment) with chronic RfDs developed by the EPA. If the chronic daily intake is below the RfD then there should be no adverse effects. Conversely, if chronic daily intakes exceed the RfD, there is a potential that some adverse noncarcinogenic health effects might be observed in exposed individuals.

B-5. RISK CHARACTERIZATION

Risk characterization involves estimating the magnitude of the potential adverse effects of the COCs under study and summarizing risks to the receptor. Risk characterization combines the results of the exposure and toxicity assessments to provide numerical estimates of health risk. These estimates are for lifetime cancer risk and comparisons of exposure levels with RfDs for a given intake. The process of characterizing risk includes the following:

- Calculating and characterizing carcinogenic and noncarcinogenic effects
- Conducting uncertainty analysis.

To quantify the health risks, the intakes are first calculated for each COC for each applicable pathway and scenario. The specific intakes are then compared to the applicable chemical-specific toxicological data to determine health risks. The health risks from each COC will be calculated to first determine potential carcinogenic effects and secondly to determine potential noncarcinogenic effects. Each of these calculations is discussed in the following sections.

B-5.1 Determining Carcinogenic Effects

Equation (B-2) will be used to determine carcinogenic effects by obtaining numerical estimates, (i.e., unitless probability) of lifetime cancer risks.

$$RISK = INTAKE \times SF \tag{B-2}$$

where

RISK	=	potential lifetime excess cancer risk (unitless)
INTAKE	=	chemical intake (mg/kg-d)
SF	=	slope factor $(mg/kg\text{-}d)^{-1}$.

Inhalation and oral ingestion SFs will be used with respective inhalation and ingestion intakes to estimate risks. Cancer risks will be summed separately across all potential chemical carcinogens in the risk assessment using the following equation:

$$RISK_t = \sum RISK_i \tag{B-3}$$

where

$RISK_t$	=	total cancer risk, expressed as a unitless probability
$RISK_i$	=	risk estimate for the i^{th} contaminant.

The excess cancer risk posed by the COCs will be determined by accounting for INEEL background concentrations of each contaminant, as summarized in *Background Dose Equivalent Rates and Surficial Soil Metal and Radionuclide Concentrations for the Idaho National Engineering Laboratory* (INEL 1995). The pathways and contaminants driving the risk will be noted in the site-specific risk assessment and will be accompanied by any necessary qualifying statements. The numerous conservative assumptions involved in the risk assessment methodology will be documented in the site-specific risk assessment.

B-5.2 Determining Noncarcinogenic Effects

Health risks associated with exposure to individual noncarcinogenic compounds will be determined by calculating HQs and summing the HQs to obtain an HI. The noncarcinogenic HQ is the ratio of the intake or exposure level to the RfD as follows:

$$HQ = \frac{INTAKE}{RfD} \qquad \text{(B-4)}$$

where

HQ	=	noncarcinogen hazard quotient
INTAKE	=	chemical intake (mg/kg-d)
RfD	=	reference dose (mg/kg-d).

If the HQ for any chemical exceeds one there may be concern for potential health effects. The HI is obtained by adding the HQs for each chemical across the exposure pathways. The HI will be calculated using Equation (B-5):

$$HI = \sum \frac{E_i}{RfD_i} \quad or \quad HI = \sum HQ_i \qquad \text{(B-5)}$$

where

HI	=	hazard index
E_i	=	chemical intake for the i^{th} toxicant (mg/kg-d)
RfD_i	=	reference dose for the i^{th} toxicant (mg/kg-d)
HQ_i	=	noncarcinogen hazard quotient for the i^{th} toxicant.

The excess noncarcinogenic hazard posed by the COCs will be determined by accounting for INEEL background concentrations of each contaminant, as summarized in *Background Dose Equivalent Rates and Surficial Soil Metal and Radionuclide Concentrations for the Idaho National Engineering Laboratory* (INEL 1995). The pathways and contaminants driving the hazard will be noted in the site-specific risk assessment and will be accompanied by any necessary qualifying statements. The numerous conservative assumptions involved in the risk assessment methodology will be documented in the site-specific risk assessment.

B-6. UNCERTAINTY ANALYSIS

There are many sources of uncertainty introduced during the risk assessment process. These emerge during all aspects of the process beginning with site field investigations and sampling and analysis through risk characterization. The various aspects within the different steps in the evaluation that may influence the outcome of the risk characterization will be documented in the site-specific risk assessment along with a qualitative evaluation of the likelihood for a particular feature to overestimate, or underestimate the results.

B-7. REFERENCES

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